

Aviation Week

and *Space Technology*

January 23, 1961

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AVIATION CALENDAR

Feb. 15-17—International Solid State Circuits Conference, Institute of Radio Engineers, Shantou Hotel, Philadelphia

Mar. 24—26th Annual Gas Turbine Con-
ference and Exhibit, American Society of
Mechanical Engineers, Shoreham Hotel,
Washington, D. C.

Mar. 9-10—General Symposium on Engineering Aspects of Magnetohydrodynamics, University of Pennsylvania, Philadelphia.
Mar. 9-10—Flight Propulsion Meeting, in attendance of the Astronautical Sciences, Cleveland, Ohio (classified).

Mr. H. B. Newton, Chairman, American Society of Mechanical Engineers, Station H-100, Los Angeles, Calif.

Mar. 13-16—Wheeled and Space Vehicle Test
eng. Conference: American Rocket Soc.
at Wilshire Hotel, Los Angeles, Calif.

Mar 18-19—Fifth National Conference on
Arabic/Spac Education, Maytown

See 3035—International Commission, is
stable of Radio Engineers, Columbus and
(Continued on page 5)

AVIATION WEEK and Space Technology

Vol. 28, No. 4

Residing under any of the following items is subject to a \$100.00 fine:

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Advocates find congressional and state officials in Portland, Maine, looking back on the New Deal. Some say that the U.S. Government should have purchased strategic property in the United States and abroad to help the country build up its own resources. Others say that the government should have been more active in the development of the country's resources.

Reinhold, F. and J. 1979. In: *Polymers and the Environment*, Reinhold, F. and J. (eds.), Marcel Dekker, New York and London, 1979, 1-10.



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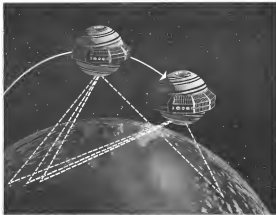
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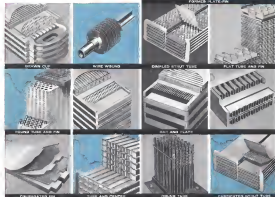
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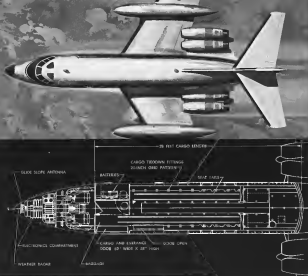
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EDITORIAL

The Parthian Shots

In taking his official leave of the nation via television President Eisenhower fired Parthian shots at the two groups that have caused him the most official embarrassment in recent years and whose concern over his policies he never fully understood. It will probably come as a considerable surprise to the millions of people in the military-industry complex of the defense effort and the smaller group of scientists and engineers who have worked so hard in the face of so many official obstacles to bring this country into the forefront of the new technology to learn from President Eisenhower that he regards them as serious threats to the future liberty of the nation. We doubt if any significant percentage of the American people will share the outgoing President's fears and we certainly don't.

It is true that the past five years have been a period of surely unusual in the Pentagon speed with prompt criticism of the President's military policies. It is also true that the country's most experienced military leader had far greater difficulty in maintaining discipline in the defense establishment during procedure than either of his two predecessors in the White House did during war.

All of the great public struggles such as Jupiter vs. Thor, Nike vs. Bomarc, minimum deterrent vs. massive retaliation and the many others that filled the headlines of the past five years marked their age prophecies because of a complete inability of the President and his civilian appointees in the Pentagon to make decisions or to organize and execute effective military planning in the new technologies.

Discipline Restored

It is notable that Defense Secretary Gates, applying both courage and intelligence to his operations, has restored a large measure of the lost discipline of civilian control in his brief tenure at the Pentagon helm. It would appear from the caliber of the new appointees to the top Pentagon jobs plus the high level of prior Pentagon experience in their ranks that the Kennedy Administration will not find the military-industry defense complex beyond their managerial capabilities. Nor are they likely to permit the constitutional demands of civilian control of the military establishment to slip from their grasp.

If President Eisenhower found his relations with the military establishment difficult he was even more troubled by his experience with the scientists based on how by the explosive impact of the new technologies of nuclear physics, electronics, hypersonic and space. The American people will recall that it was not until after the

Soviets had launched the first Sputnik that the President was fit to appoint a scientific adviser and in a grand gesture invite the leading scientific minds of the nation to a White House gala dinner. This dinner was never reported nor did any scientific panels of some, with the exception of the single official advice, ever penetrate the White House inner circle for any continuous input into the President's thinking.

It is entirely understandable to find an older man successful with older military techniques never used by energetic young men whose discoveries spawned new ideas and problems for the chief executive's administration of the nation. But it is tragic that that gift was prevented to witness the decisions so clearly revealed by President Eisenhower's latter warning of the danger "that public policy could drift from the expertise of a scientific-technological elite."

A Glaring Example

The difficulty President Eisenhower had in understanding the implications of the technological revolution that has so radically changed the world is typified in his final budget message on the Aircraft Nuclear Propulsion program. There he blithely ordered the technicians to arbitrarily and unaccountably select one of two widely divergent approaches to the problem regardless of the fact that neither has yet been developed to a point where the technical data required for a wise choice is available.

We agree with President Eisenhower's thesis that "only an alert and knowledgeable citizenry can compel the proper balancing of the huge industrial and military machinery of defense with our practical methods and goals so that security and liberty may prosper together." But we respectfully suggest that the American people and consequently more careful than their executive leaders and considerably less manipulation of the news to conform to preconceived policies than has been the fashion if they are to be sufficiently "alert and knowledgeable" to measure up to the severe challenge of our times.

It is one of the major hallmarks of the era past ending that our executive leaders did not fully understand the implications of the new technologies on military power and the nature of that when in the international community. From the caliber and experience of the leaders now being appointed to these positions of executive leadership in the new government it is evident that President Kennedy realizes he must strive hard to achieve the understanding which is so vital to cope with the problems that beset us on all sides.

—Robert Hite



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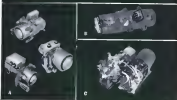
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WHO'S WHERE

In the Front Office

William H. O'Brien Jr., New York, is a director of Long-Term Enterprises Inc., Dallas, Tex.

Charles M. Allen, vice president and director of engineering, Industrial Products Division, International Telephone and Telegraph Corp., San Francisco, Calif.

Donald L. Johnston, New York, chairman, a director of Northeast Airlines, Inc.

George H. Smith, vice president and manufacturer, Foster Steel Co., a division of Parker Industries Corp., Birm. Ky.

Sam J. Fanner, vice president and chief of Chemical Waste Division of General Dynamics Corp., San Diego, Calif.

Robert Keith Gray, formerly secretary of President Eisenhower's Cabinet, is now general of Hill and Knowlton Inc., Washington, D. C., succeeding Anne Miller appointed to the New York headquarters.

Dr. Harold Lewis, a vice president, Electro-Optical Systems, Inc., Pasadena, Calif. Dr. Lewis will manage the company's new federal Quantum Electronics Division.

Paul H. Steinfeld, vice president, represents the Personnel of the Los Angeles, Calif. and Mason M. Holmes, director of manufacturing.

Allen Corp.'s Learning Division has appointed the following new executives for its Management (P) division: John M. Fennel, C. R. Bader, business manufacturer, P. J. Gaudin, controller, C. B. Wang, vice president.

David J. McFarland, vice president and chief of the California Division, "Natural medical use products," Walter J. Gaudin, president, John F. Peterson, maintenance and operations.

Robert F. Stewart, vice president and chief of the California Division of The Cybernet Co., Milpitas, Calif.

William H. Ross, vice president and chief of the Applied Borg Electronics Corp., Springfield, Ill.

The Bender Chemical Co., New York, N. Y., has formed three new divisions and transferred the following to new divisions: George J. Ludwig, chairman of Chemical Division; Ken F. Hanson, West Coast Division; and John C. Wobler, Therapeutics Division.

William W. Baker, chairman, Space and Information Systems Division, North American Aviation Division, Calif. Also R. J. Sweeney, director of research, Kenneth E. Cox, director of research.

John L. Gardner, corporate secretary and contracts and legal control, Fairchild Co., and Applied Corp., Englewood, N.J.

Houses and Elections

C. B. Smith, president of American Air Lines, Inc. has selected by Senate's Post #1971 of the American Express Co. to serve the 1981 seat in the United States Senate without an extraordinary substituted member from the various regions.

Robert L. Baker, president of Jody & Baker, Inc. has been elected president of the Institute of Space Engineers according to the Dr. W. R. G. Baker of General Electric.

INDUSTRY OBSERVER

First attempt to restart the engine of the Lockheed Agena II second stage is again planned for the Discoverer XX flight. The fifth stage has been returned to Arnold Engineering Development Center facilities under simulated space conditions, but never in space.

An F-105 is considering a land recovery technique for the B-6 advanced capsule in the Saturn reconnaissance satellite system. Alternatives include recovery by parachute alone and by partial glide, terminating in a final landing by parachute. Saturn ultimately is to be capable of transmitting pictures directly from orbit, eliminating the recovery requirement.

Minuteman test vehicle is programmed to fly 4,000 mi in its first flight scheduled this week at Atlantic Missile Range.

Modification of the Atlas booster to be used with Mercury capsules will involve use of heavier gip used for the upper portion of the Saturn. Atlas launching Saturn and Atlas satellites also will have this stronger upper section.

Design engineering inspection of the USAF Martin Titan II missile and launch support systems will be held in Denver Jan. 31, covering a full week meeting of the teams.

Interim wheel concept is being considered for Saturn stabilization on an alternate approach to the machine, get action for long duration control of the satellite to keep its nose pointed toward the earth for reconnaissance.

Spread spectrum technique, transmitting signals over a wide range of frequencies will be used to minimize the possibility of jamming the earth current radio system which will control flight of Minuteman ICBMs from orbit. Air Force plans to continue development of earth current communications and the Command and Control Development Division recently issued requests for industry proposals. Rome Air Development Center will manage the project.

Reliability analysis of the Saturn space booster, made by Arco Research Corp. for National Aeronautics and Space Administration, indicates the first stage vehicle's various vehicles would be kept, eliminating possible huge increase in any new design. Arco reported to NASA last week on the analysis.

Apollon spacecraft will weigh between 15,000 and 20,000 lb. National Aeronautics and Space Administration will launch the vehicle on earth orbit missions with the first-stage Saturn C-1 and on orbital missions with the main stage Saturn C-2.

Office of the Director of Defense Research and Engineering has asked 60 top U. S. electronics scientists and businessmen to indicate the most important areas of electronics research which should be supported by Defense Department in the next several years. The list includes Dr. Joseph B. Wideman, new White House scientific adviser.

Hot tests of the Pratt & Whitney LR-113 liquid hydrogen engine are scheduled within the next few weeks at Cannon Airframe Systems Cannon state test facility, following successful cold flow tests. The cold flow tests made with the engine complete with turbine and plumbing lasted 15 to 30 sec.

Project Mercury tracking station at Bermuda is being modernized in the backup control center for orbital flights. It will have the same equipment and display as the primary control station at Cape Canaveral.

Project Mercury recovery force will consist of 20 destroyers by ship and 40 aircraft spread over the near planned recovery area in the Atlantic Ocean. Because of the low probability of the rapid landing outside a planned area, an additional emergency recovery force will be available and will duplicate the area rescue plan for transatlantic presidential flights.

LIBRASCOPE COMPUTER FACILITIES

Shown below is a composite view of Librascope's facilities where a variety of computer systems are currently in different stages of design and production. Some are strategically involved with national defense...others deal with business and industrial process control. Each is uniquely designed to answer a particular need. The success of these systems illustrates the value of Librascope's engineering philosophy: A decentralized organization of specialized project teams responsible for assignments from concept to

delivery...and backed up by excellent research, service, and titles. For your computer requirements, call on the company of diversification in computer technology is unsurpassed. Division, General Precision, Inc., 803 Western Avenue. For career opportunities write to John Schrafft, Engineering



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Washington Roundup

Chief Candidates

Contest for chief and vice chief of staff of the Air Force is still far from settled, but speculation is strong that Lt. Gen. Richard A. Schriever will be *vice chief* before the year is out. Schriever's Air Research and Development Command is the main drive behind Air Force attempts to build a large space program, but Schriever also has been careful to acknowledge the importance of ground-based work.

Air Force Space Study Committee (see p. 33) named by Schriever to survey the present and future potential of space efforts, is to name Dwight A. Christensen of the Wehrer task force, that prepared a report for President Kennedy and it has Dr. Jerome Wiesner, the new White House science advisor, as a key member.

Speculation is that Lt. Gen. Frederick Storch, USAF commander, may move into the *vice chief's* job before Gen. Thomas D. White leaves as chief—then come up with Schriever becoming our chief. Gen. Thomas Power of Strategic Air Command also continues to be mentioned for the top job but either way, Schriever appears to be the front runner for the number two spot. The close friendship with Vice President Lyndon Johnson may be a deciding factor when the choices are made.

Nuclear propulsion projects may be in for rapid acceleration under the new administration. That probably will even include the pursuit of both approaches to a nuclear aircraft engine. Although Johnson's decision will have to be made on what is to be funded, the opportunity to afford goals and membership of important advisors, groups, and a big push forward with nuclear energy than government jobholders in the past few years have had.

More Defense Money

An additional \$2 billion in defense funds, probably split between a supplemental request for Fiscal 1961 and an amendment to the Fiscal 1962 Eisenhower budget is expected to be reported from Congress by the Kennedy Administration.

Members served last week turned over shopping lists to Deputy Defense Secretary Russell Gilpatric. These will form the basis for the money requests. The services now bid to concern themselves primarily with need rather than cost. While the warrent in operations and maintenance needs which only are being blamed for increased aircraft accident rates in both Navy and Air Force.

Gradual reduction of flight pay for military pilots removed from flight status, which was recommended by President Eisenhower in his budget message, will face tough shelling in Capitol Hill. Both there and among non-pilots within the services there is little sympathy for the pilots. The campaign is organized in the Air Force by the large number of pilots who have little other income in administrative training, making it hard to find non-flying jobs for them.

Air Union, the proposed consolidation of Air Force, Airline, Lockheed and Sabena, is being revived after a long period of disinterest in basic issues which had many elements to think the project was dead. All three flag lines except German's Lufthansa have been ordered by their governments to pursue talks.

Air Force will attempt to fly a Boeing B-52 12,390 miles non-stop from Yafes AFB, Japan to Tammam AFB, Syria via Gibraltar City, to have the longest non-stop flight by Navy's Lockheed P2V-7, the Ticonderoga, on a 10,625 mile non-stop flight from Pearl Harbor to Cebu, on Sept. 29-Oct. 1, 1959.

NASA Uncasy

Delays in naming a new National Aeronautics and Space Administration chief has caused the agency that has already lost much of its 1959 fiscal year budget. The top staff question their future in view of the White House's criticism of NASA management. NASA Administrator Keith Glavin was the first Eisenhower appointee to resign—on Dec. 25—and a quick decision on a successor would have saved NASA an effective voice in the early days of the new administration.

Chairman Richard Russell will name a Senate Armed Services Subcommittee to update the Silver Act conflict of interest law affecting government appointees.

Congress may act on the organization law this year, although it doesn't expect until mid-1962, because next year will be a busy election year. First National Revenue Taxation Committee (see below) recommendations by Apr. 1. Congress, Industries Asia will sign putting the law on a vote before house if it is to be continued and will urge relocation of the new independent Reorganization Board to the Defense Department.

Expect Sen. Mike Mansfield to introduce a bill authorizing government guaranteed loans for the purchase of cargo aircraft. Senate bill died in the last session.

—Washington Staff

Defense Budget of \$41.8 Billion Asked

Eisenhower plan calls for \$532 million increase; Kennedy's amendments expected in next few months.

By Larry Bonds

Washington—Eisenhower Administration last week asked Congress for \$41.8 billion in new Defense Department funds under a budget that is expected to be amended considerably by the Kennedy Administration in the next few months. The request is for \$532 million more than Congress appropriated last year.

Annual spending under the Eisenhower defense budget for Fiscal 1962, exclusive of military assistance to other countries, is estimated to be \$42.9 billion, an increase of \$1.4 billion over the estimated expenditures for the current fiscal year. This is the highest figure since World War II with the exception of Fiscal 1955, which was only \$800 million higher.

Fiscal 1962 money that would be committed for spending is estimated at \$45.85 billion, a decrease of \$625 million from the figure for the current fiscal year.

Balanced Budget

President Eisenhower requested a total national budget of \$56.9 billion for Fiscal 1962, estimating that the Fiscal 1961 budget would be currently in balance by \$100 million and that his budget for Fiscal 1962 would produce a surplus of \$8.5 billion.

New money requested for the Defense Department is divided \$17.9 billion for Air Force, \$12.2 billion for Navy, \$14.4 billion for Army and \$1.4 billion for the Office of the Secretary of Defense.

Both new money requested and annual spending expected will increase very slightly for aviation. Aircraft spending will be slightly higher than last year, but new optional authority will be lower than Fiscal 1961 by \$397 million. Both Air Force and Navy's

active aircraft inventories will decrease, while the Army's will increase. Manpower level remains at 2,492,000 people.

President Eisenhower said that major emphasis was being placed on the Navy's Polaris submarine-launched ballistic missile, the Air Force's Minuteman solid propellant intercontinental missile, the Air Force's B-70 supersonic bomber and an airborne alert, and Army and earth communications.

Chief criticism from the military services, aside from that of increasing less than they requested, is that personnel and material costs have increased about 3.5% per year while new money requested for these categories for Fiscal 1962 represents an increase of only 1.5% over Fiscal 1961.

Cost Increases

This trend has been going on since the end of the Korean War and is causing a financial squeeze, officials say. The answer, they say, is to stop making cuts across the board in a number of programs and to concentrate on certain programs instead. The budget document itself takes note of increased operating costs by pointing out that the cost per hour of flying a Republic F-105 fighter is almost three times that of the North American F-100.

The Eisenhower budget provides no new money for development of the Navy-Douglas Matson study or the USAF-Douglas Searle air-launched ballistic missile. Fiscal 1962 money has been spread over both Fiscal 1961 and Fiscal 1962 for both projects, leaving it to the Kennedy Administration to decide whether they still be given additional funding from an uncommitted Fiscal 1962 budget. Kennedy is left with a similar situation on Aircraft Nuclear Propulsion program (see p. 28).

Defense Department began last year to shift money that actually supported research and development out of the procurement category and into a new category called research, development, test and evaluation. It had hoped to complete the transfer this year, but this has not been done for USAF's ballistic missiles, the B-70, the new cargo aircraft for the Military Air Transport Service and for some Navy aircraft development.

New money requested for procurement of all types is \$13.128 billion, a decrease of \$73 million from the previous year. New money that will be allocated is estimated at \$14.641 billion, down \$652 million from Fiscal 1961. Procurement expenditures are expected to be \$14.772 billion, up \$619 million from last year.

Major Military Obligations and Expenditures

	(in billions of dollars)							
	FY 1960	FY 1961	FY 1962	FY 1963	FY 1960	FY 1961	FY 1962	FY 1963
Air Force								
Research, Development, Test and Evaluation	4,340	3,708	4,827	3,883	4,916	4,031	3,197	3,867
Operations and Maintenance	4,486	4,202	4,816	4,406	4,869	4,569	5,111	5,064
Procurement	5,460	5,202	5,390	5,187	5,100	5,202	5,427	5,418
Active Aircraft Inventory	4,340	4,218	4,376	4,504	4,616	4,444	4,410	4,426
Army								
Research, Development, Test and Evaluation	1,212	1,209	1,107	1,210	1,336	1,363	1,347	1,363
Operations and Maintenance	2,664	2,644	2,644	2,775	2,875	2,929	2,869	2,929
Navy								
Research, Development, Test and Evaluation	1,393	1,372	1,431	1,496	1,587	1,644	1,516	1,585
Operations and Maintenance	2,521	2,501	2,546	2,579	2,591	2,523	2,416	2,438
New Obligated Authority								
Research, Development, Test and Evaluation	100	150	93	119	160	129	172	167
Operations and Maintenance	300	466	650	200	446	600	697	697

Aircraft-Missile Strength

	Actual 1960	Planned 1961	Planned 1962
Air Force			
Combat Wings	10	8	6
Strategic Wings	20	20	24
Air Defense Wings	20	18	16
Tactical Wings	30	30	30
Combat Support Wing Force	117	111	107
Air Refueling Squadrons	40	40	40
AFMIS Air Transport Squadrons	30	31	31
AFMIS Transport Squadrons	20	20	20
Active Aircraft Inventory	14,712	16,445	16,445
Navy			
Polaris Submarines	10	9	9
Carrier Air Groups	10	10	10
Carrier Air Support Squadrons	11	11	11
Patrol and Mining Squadrons	47	50	57
Medium Air Wings	9	9	9
Active Aircraft Inventory	8,462	8,740	8,461
Army			
Antiaircraft Missile Battalions	404	375	474
Surface-to-Air Missile Battalions	24	26	30
Active Aircraft Inventory	4,495	4,447	4,734
Helicopters	3,400	3,474	3,441
Fixed-Wing	2,460	2,462	2,494

* Plus temporary attack force increases.

President Eisenhower asked Congress to appropriate the extra defense budget to the Secretary of Defense, rather than to the three military departments as recommended in the defense appropriations bill proposed by President Kennedy by a group led by Sen. Stuart Symington (D-Mo.).

Congress, however, generally grants its committee specific control over service appropriations and is expected to pay no attention to this request. The secretary himself has transfer authority over a \$150-million appropriation to finance a \$150-million program, and a \$150-million transfer fund and authority to transfer money from any service account into the Advanced Research Projects Agency, and back to any other service account.

Military Expenditures

The money spent to buy a total of 1,420 aircraft in Fiscal 1961, including 644 for Navy, 715 for USAF and 661 for Army. The Army will continue development of a new reconnaissance aircraft and USAF will undertake development of the CX-1 jet cargo transport which actually is being ordered with Fiscal 1961 money.

For budget details on procurement of aircraft, missiles and ships on research development test and evaluation and on operations and maintenance see the accompanying table.

Highlights of the USAF program are:

- Martin T-16 intercepter missile is USAF's largest program. In the largest of four different budget requests which the services submitted to De-

fense Department—a budget with a total 50% above last year—USAF asked \$875 million for T-16. The Advanced Research Projects Agency's CX-1 intercepter is also in the largest of its requests.

- Raytheon budget of \$80 million in the Fiscal 1961 budget has been increased by a reprogramming that adds another \$70 million and is in 1961 money.
- General Atomics ICBM will get \$201 million which eventually will cover procurement for 15 squadrons.
- After consideration will total \$194 million, including \$14 million for the straight cargo version of the Lockheed C-119B, \$70 million for the straight cargo version of the C-119B and \$24 million for the CX-1.

- North American B-70 development will cost \$574 million. First flight test is due in 1965. B-70 funds through Fiscal 1961 had totaled close to \$10 million, including \$385 million in Fiscal 1961 total.

- Seventy-two Boeing KC-135 tankers will be bought at \$116 million. A request for an additional construction program review of the C-119 is denied.

- Total of \$990 million will go for Republic F-105—\$770 million for 192 fighter bombers and \$220 million for reconnaissance interceptors.

- Northrup F-5B will receive \$128 million. T-16 intercepter will get \$38 million and the Lockheed T-70 (Defense) \$10 million.
- Aircraft modification will require

\$617 million, and replacement spare will need \$871 million.

Space funds include \$276 million for the Saturn propulsion research, space satellite and space station by the Males contract early warning satellite.

Defense's budget for Fiscal 1961 is divided approximately \$450 million for items on the shelf to keep on-shelf at Strategic Air Command's B-70 bombers on a complete airborne alert status. The new budget includes funds to buy spare parts for the F-105D jet missile, lack less to increase engine and life extension equipment in operation in part of the alert program, and more for additional instruction training more reserves for the alert. Total for both years for airborne alert is estimated at \$110 million. USAF has not yet achieved the objective of preparing one-fourth of the B-70s hours before to go on airborne alert on short notice.

New Programs

Highlights of the Navy program are:

- Procurement of 644 aircraft with a total of \$1,777 million. Production will continue on the North American A-1H heavy attack bomber, the Douglas A-1Z and A-1Z light attack aircraft and the Grumman A-1Z low-level attack aircraft. Money for the McDonnell F-4H fighter, ordered at \$275 million in Fiscal 1961, will be increased in full funds for the Grumman W-1Z early warning carrier aircraft, now funded at \$16 million. New money also includes the Lockheed F-9, formerly 1988-1, Kansas H-108-1 and Lockheed

ARDC Preparing Report Stressing Need for Military Space Program

Dallas, Tex.—Air Research and Development Command has set up a committee of about 15 prominent scientists and administrators to take a frank, completely unbiased view of U. S. Air Force space programs that will be required to provide this country with an adequate defense, ARDC Commander Lt. Gen. Bernard A. Schriever issued last week.

Involvement with the subject, which Gen. Schriever expects to have in his hands in mid-February, will provide the Air Force with a major tool in preparing a study stronger and more informed military space program than it has had available in the past. Even more important, it indicates that the Air Force will seek a much larger role in the national space program than it has been permitted in the past because of growing dependence on the leadership on space plans directed toward scientific and peaceful pursuits.

The report is also to be made available to the National Space Council, Gen. Schriever noted, and he expects that under the close leadership of Vice President Lyndon Johnson, there should be "formidable changes" in the Air Force position as well as the national program.

Gen. Schriever, speaking at the annual meeting of the American Astronautical Society, stated that he was greatly concerned with the rising anxiety over American that the U. S. civilian space program represents our national space program and he emphasized that the civilian effort cannot be too tightly space programs. "Increase the military and civilian space space," he said, "do not merge into the single issue."

"Our military requirements for space will not be completely satisfied with the developments under way in programs in our civilian programs," he stated, and also noted that the importance of satellites and other space systems in national elements of our military strength is not fully appreciated.

The anxiety is, he said, in the U. S. strategic position—and our relations with the world—brought about by atomic energy and nuclear missiles in the space age, he said.

In one manner, he said, space programs, on base, of necessity, look programs with the private sector, but in our country for peace we may not have fully explored all avenues leading toward the preservation of peace, he said.

Schriever indicated that perhaps a reorganization of the importance of

USAF programs, aimed at improving communications, detection and communications, has been largely due to lack of perceived Soviet interest in these fields, which has tended to give them more priority in many American minds. He stated that the Soviets apparently have considerably less need for such systems than does the U. S. Among the systems under study is a proposed larger reconnaissance, to avoid a hazardous lead in the nuclear control world of today.

In the field of civilian intelligence the USSR has no problem. Schriever stated that our study of the strategic, scientific and military of the U. S. and the free world. To reduce the imbalance in intelligence, space systems possess the greatest potential to accomplish U. S. intelligence objectives and Gen. Schriever said that U. S. military attack on the U. S. is millions of feet higher than the U. S. military of Pearl Harbor ended up in the air.

Schriever also stressed "definitely not" is a query as to whether he thought that the military space program would

be induced by setting up a completely new, independent U. S. space unit, noting that "we have grown tired with three services without adding a fourth." He stated that the program should take the performance of military space systems into account, but emphasized that in his opinion, the U. S. Air Force should be the predominant service in space.

A Soviet, held in cooperation with the AAS meeting here, had as participants, Gen. Schriever, Walter von Braun, director of NASA's Marshall Space Flight Center, Otto Trost, House Committee on Science and Astronautics, and Gen. Fred L. Wiggles, director of the Southern Hemisphere Observatory.

Most agreed that lack of money, rather than talent, was the current handicap suffered by industry and government agencies in developing present capabilities into more effective space programs. Von Braun and Gen. Schriever believed that greater flexibility in budget spending would permit increased benefits. However, Congressman Trost indicated that he did not favor relaxing such controls.

Gen. Schriever, in discussing man-in-space, stated that he believes the first serious step is that of a "sequenza." One of the big problems in space opera-

tions is man time in labor of man-in-space and with the advent of space bits of sending big payloads into space there would be a great necessity for man-in-space personnel to protect the millions of dollars of investment that these large vehicles will represent. Not requirement would be that it is space to control, to adapt, to give, to have human observation, and perhaps through man time in control vehicles through the atmosphere and return them to designated points on earth. That is not question he noted that we will use the space stations for transportation between points on earth because of the tremendous speed which, through that method will achieve.

Von Braun and Wiggles emphasized the need for space stations, more than research to build them, transmittal of knowledge to make better space programs work. Current research funding a lot of money, von Braun indicated, in a one the large sum being expended on programs for the moon, while other experiments are made available to astronomical laboratories which could provide available information regarding the environment and problem lack of man-in-space, open aimed on the moon or other planets. What is needed here he felt was providing someone as man-in-space for the commanders and men for passing, ground-based, who can reach with space program.

A critique of U. S. man-in-space programs—such as Project Mercury—was given by Lloyd V. Berkley, president of Associated Universities, Inc., who stated that the man-in-space program is not as important as we do not need money and money, but programs which would be man-in-space, on such scientific grounds. He indicated that he felt our man-in-space effort was somewhat based on our badness in the "weight lifting competition"—although the USSR seems to be behind the U. S. in space efforts. He felt that at the present time there is a "paradoxical" with man-in-space programs to the detriment of our capabilities for capturing real information in large quantities using automatic instrumentation, a field in which we are ahead of the Soviet.

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Space Conflict Blamed On Lack of Direction

Washington—Lack of clearly defined national space booster objectives has resulted in attempts to degrade the position of the National Aeronautics and Space Administration by critics in private groups within the Air Force and House of Representatives, according to a report of space committee report.

The report says the situation is not

as mean time to failure of comparison with the advent of space bits of sending big payloads into space there would be a great necessity for man-in-space personnel to protect the millions of dollars of investment that these large vehicles will represent.

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The committee report includes an analysis of existing booster technology in liquid solid, hybrid motor and

Air Force Space Study Committee

Dallas—Air Force Space Study Committee (a study) is a kind of unique advisory vehicle and committee formed under the title of advisory panels and subcommittees. These committees are:

- **Vehicle Development Committee.** Chairman was a member of the Western test force reported recently in President Kennedy's space and missile program (AW 10, p. 9). He also is a member of Aerospace Corp. and president and board chairman of Hyman Manufacturing Co.
- **Dr. Charles C. Leonard,** director of Aerospace Corp. and professor of physics at California Institute of Technology.
- **Dr. Jerome H. Wiesner,** Kennedy's White House science adviser and one of the original members of Aerospace Corp.
- **William C. Foster,** vice president of Oldenhausen Chemical Co. Foster headed the Carter Committee.
- **Dr. Edwin Land,** president of Polaroid Corp., who served with Wiesner and Gould on the Kennedy space task group.
- **Dr. W. Randolph Lovelace II,** head of the Lovelace Clinic and chairman of the National Committee on Life Sciences.
- **Dr. Arthur K. Sargent,** director of Aero Corp.'s Eastern Research Laboratory.
- **Dr. W. O. Ebert,** vice president research Bell Telephone Laboratories.
- **Dr. Frank T. McClure,** chairman of the Research Council of Johns Hopkins University Applied Physics Laboratory.
- **Dr. Harold Brown,** director of the Lawrence Radiation Laboratory, operated by University of California for the Atomic Energy Commission.
- **Dr. Stanley M. Ulam** of the Los Alamos Scientific Laboratory, also operated for AEC by the University of California. Work done by Ulam on atomically induced nuclear transformations, played a key part in development of the hydrogen bomb. Ulam also proposed two methods for using small nuclear explosives in space.
- **Dr. Robert R. Serber,** physicist in Charge of the Office of General Studies, Air Force Project Office (AW Feb. 28, p. 30). This work, now headed by Air Research and Development Command, has received a total of approximately \$2 million in data. Wiesner's report to Kennedy, called management of "entire new study which might lead to self-heating" and called for an example.
- The Air Force Space Study Committee was established on October 18, November, it was organized a group headed by Dr. Theodore Tetro, who is now president of General Atomic and is technical director of Project Orion.
- **Dr. Conrad Loewner,** a theoretical physicist from Los Alamos.
- **Dr. Charles Townes,** member of the Mann and a vice president and director of research for the Institute for Defense Analysis.
- **Dr. John V. Neugebauer,** professor of mathematics at Princeton University.
- **Dr. Mark Kay,** of Cornell University's mathematics department.

on reduction of the Air Force budget from about \$100 billion to \$70 billion, which creates inevitable conflicts of interest. The committee is likely to investigate the over of military programs in space to be held within a month (AW Nov. 21, p. 17).

Because of what the committee is expected to do, it is likely that the committee will be able to provide competitive atmosphere, it said Congress should consider placing responsibility for booster development under a single agency. An space program group, the committee said, will find the possibility because that NASA and Defense Department booster development efforts will begin to duplicate each other.

Large boosters should be developed to meet both military and civilian requirements because of high costs according to the report. The committee may be the approval Saturn out per launch will be \$17.5 million, and Centaur will be \$9.1 million.

The committee report includes an analysis of existing booster technology in liquid solid, hybrid motor and

solid rockets. Committee on Launching systems, advances the large boosters in a study of pumps, rates, pressure regulation. Possible areas for increasing specific impulse to 500 sec. test, boosters and to propellant, and more energy and booster.

• **Solid** are also increasing in ruggedness, reliability, stability, simplicity and economy, but effort is required to overcome their full potential.

• **Hybrid** boosters, solid fuel and liquid oxidizer, show promise in increasing flexibility of both utilization and all solid boosters. Critical problem is low thrust operation of the oxidizer during the use of low thrust motor.

• **Nuclear** boosters show great promise, but difficulty is in development places the firing by such a system in 1970. Commercial nuclear test chemical development should not be abandoned in face of existing risk.

• **Electromagnetic** systems should be used in research but due to heavy weight required, only application depends on major technological advances.

Moon Ionosphere Has Radio Wave Effect

Dallas—The discovery of a "radio type of ionosphere" shows the moon's surface that has effects on propagation of radio waves similar to that of the ionosphere of earth and Venus, and therefore may play a role in communications with the moon, we described last week by Dr. S. P. Shuger of the University at Maryland.

In the usual planetary ionosphere, the upper atmosphere is partially ionized and the density of the ionosphere is less than the density of atoms. Dr. Shuger noted, "For example, for the earth, near 300 km. [150 mi.], the electron density is 1 million per cubic centimeter, the atom density is 10 billion atoms per cm. But for a body such as the moon, such as the moon's body is too small to serve as an atmosphere, the electron is different, he explained."

"We estimate the density of atmosphere at less than 100 hydrogen atoms per cubic centimeter, but the density of electrons is 10,000 per cubic centimeter near the lunar surface," he added. The ionosphere which exists this electron here is about a hundred times the ionosphere of the earth.

When solar particles constantly bombard the lunar surface and electric photo electrons and those of the very highest energy will escape into interplanetary space and leave behind a positively charged moon, with an approximate potential of 30-40 v., he reported.

But the lack of the photoelectrons do not have enough energy to escape. They are emitted from a space ionosphere of less than 100 atoms per cm. at the million per second. They spend a little time above the moon before being ionized under the influence of a strong electric space charge field, according to Dr. Shuger.

According to Dr. Shuger, the strength of this space charge field has been estimated and he has been found large enough to cause the ionosphere effects on the moon. The field would probably charge that particles that are ionized. Because of this positive charge they induce and partly shield the negative space charge of the electron cloud and allow it to expand to a greater distance, of the order of several feet. The electron field is a rapid, the dust particles fall back to the surface, but others rise to take their place. This electron provides on the moon's "hot ionosphere" made up of positively charged dust particles and negative electrons, Dr. Shuger said.

Great Britain, France Promoting Common European Space Program

Paris-France and Great Britain, in an effort to spur the beginnings of a common European space program, are jointly inviting 11 other European nations to attend a governmental conference in Strasbourg beginning Jan. 30.

A major goal of the two-line nations at the conference will be to tell representatives of the other nations at a common breakfast meeting developing the British Blue Streak IRBM as the first stage and the French Véronique research rocket as the second stage. (AVW Dec. 26, p. 25)

British Minister of Aviation Peter Bonebrake was scheduled to visit Italy last week and Switzerland this week to discuss the Strasbourg meeting and boost the cause of the Blue Streak-Véronique combination. He had just earlier visited in West Germany and Luxembourg. However, in West Germany at least, it is believed that he got with little success. (AVW Jan. 16, p. 36)

A joint statement issued by the British and French governments said commonwealth nations also are being invited to attend the conference. Those rules and names were not specified.

Invited European nations include those which attended an organizational meeting in Geneva last fall to pave the way for an European Space Research Center (AVW Dec. 17, p. 29) plus two others—Italy and Austria. Those attending the Geneva session and invited to Strasbourg are Belgium, Denmark, France, West Germany, The Netherlands, Norway, Spain, Switzerland and Sweden plus Great Britain and France.

Italy took the first successful step in its space program with the launching of a two-stage Nike-Cajon containing a turbine flow experiment to monitor wind shear and activity up to an altitude of 100 mi. Bombs and technical assistance were supplied by the U.S., and the payload was designed largely by Italy's National Research Council. The Council and the Air Ministry each have set aside \$450,000 to continue upper air research, eventually with allied rockets developed in Italy. Launch was from Pombalidage in the east coast of Sardinia.

The Strasbourg conference apparently has no direct connection with the earlier Geneva meeting, although all said stressed that it would not work at cross purposes with the earlier session in Switzerland and its projects.

At that time, it was announced that a committee charged with drafting laws and statutes of linking the Space Research Center a reality would meet in

Paris after at least six governments representing 70% of the group's \$700,000 organizational budget had given formal approval to the project. It is believed that this goal has not yet been reached.

Seven two of the nations—Sweden and Switzerland—are neutral nations, participants at the Geneva meeting and the French and British nations stressed that the program was strictly non-military. Objectives include communications and weather observation probes and satellites.

In another move in which it was again declared that it would not threat to the Geneva objectives, France has agreed to a cooperative space venture with the U.S. similar to those already agreed at with Britain and Canada. This call for a Common Weight Scout developed for the National Aeronautics and Space Administration to boost a French payload into orbit in late 1962.

Formal agreement with NASA is expected in March during the visit of a French delegation to Washington headed by Pierre Papagnin, delegate general to the National Committee for Scientific Research, and Pierre Auger,

president of the French Committee for Space Research and a leading figure at the Geneva conference.

France also is working on a national space program, it is indicated that this program's purpose for a prime effort with the U.S. is to give the Europeans a place in space at a time before it is a booster vehicle, as the Blue Streak, is fully developed.

Agreements already have been signed by the U.S. and Britain for Scout-launched electron measurements satellites, and by U.S. and Canada for magnetospheric studies. Initial Canadian experiments will be launched by Scout, and later satellites in Thor Agena B.

Rover Bidder Briefing Delayed for Decision

Washington—Industry, leading on the Project Rover nuclear propulsion rocket, scheduled for last week, has been postponed pending determination of how, reportedly, will be distributed among the Atomic Energy Commission, National Aeronautics and Space Administration and the prime contractor.

A team of advisers has been formed to define the general concept of nuclear space propulsion, and to determine the most feasible list of bidders. Called the Nuclear Propulsion Study Committee, the team is composed of representatives of Ford's General Corp., United Technology Corp., General Electric Rocket Corp., Aerojet-General Corp., Rockwell's Thiokol of North American Aviation and the Martin Co.

Nine new design bids, later set for the mid-1960s, leading bid bidders will have 60 days after the briefing in which to submit proposals for the Rover engine. In addition to basic propulsion capabilities, bidders will have to provide capabilities in electrical power and hydrogen handling fields.

ITT to Moon-Bounce Signals to England

Washington—International Telephonic & Telegraph Corp. will begin cross-country communications experiments soon between Naples, N. J., and England, following receipt of Federal Communications Commission approval when and temporary assignment of frequencies in the 2,360-mc. band.

ITT expects to transmit both tele-type and voice by moon bounce. Tests will be expanded later to include narrow-bandwidth transmission television using new 180-ft. diameter Reberland passive satellite above National Aeronautics and Space Administration expects to launch the year.

Involvement: Space Tag—another advanced program at Martin demanding major talent to make environmental adjustments for test in space. To include suitable marking the hardware to include into space programs. Martin of Denver offers exciting research. Write direct to N. M. Pappas, Director of Technical & Scientific Staffing, The Martin Company, Dept. 9-13, P. O. Box 1779, Denver 1, Colorado.

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Long Terms Urged for Defense Officials

By Katherine Johnson

Washington—Defense Department's new top officers promised to serve faithfully—will add to leave for the President—the Senate moved quickly to ask for confirmations.

Embarked at the frequent change in top Pentagon posts, members of the Senate Armed Services Committee at confirmation hearings specifically obtained this commitment from each of Kennedy's appointees. Robert McNamara, secretary of defense; Roswell Gilpatric, deputy secretary; Dr. Elia Sizer, Army secretary; John Connally, Navy secretary; and Eugene Zakaria, Air Force secretary.

The intent of long-term defense jobs, according to the two top men, was the point was established in 1947. Service of defense secretaries has averaged less than a year and a half.

The Senate set the background for long-term Pentagon service last year by voting a resolution providing that appointees "shall indicate their willingness to serve so long as the President desires" because "the complexities and technicalities of national security problems have steadily increased the amount of government experience required before responsibility can be discharged effectively."

The nominees met quickly and unanimously approved. Following months of planning, McNamara, Sizer and Zakaria spent on high points of each of the nominees in Washington as well as Democratic capitals. This was in contrast to the unpopularity shown in the 1955 confirmation of Charles Wilson as secretary of defense, which developed into Wilson's reluctance to tell his staff to conform with conflicting regulations and established an antagonistic behavior. Wilson and Armed Services Committee members in the case of Sen. Richard Russell (D-Ga.) subsequently charged the antagonism was better left open and free throughout Wilson's tenure.

The committee also expressed misgivings but work for five of the eight evident secretaries of defense posts: Charles H. Hays, controller; Cyrus Vance, general counsel; Paul Nitze, in international security; (then) Arthur Schlesinger, public affairs; and Thomas Morris, supply and logistics.

Confidence in the new staff was a technical legal problem. All of the appointees, with interests involving possible conflict readily agreed to state in the division of the committee's legal counsel.

Only McNamara had had a substantial holding in a major defense contri-

nor. He proposed putting \$1.1 million after taxes, from the sale of Ford Motor Co. stock in a trust, to support the new staff's conditions in the detailed assignments of the trust, and volunteered to periodically make public the movements of the trust and his own income tax returns.

Under questioning, McNamara told the committee:

• He and Deputy Secretary Gilpatric will participate in sessions of the Joint Chiefs of Staff, a practice started by outgoing Secretary of Defense Thomas S. Gates.

• There will be no executive control to discourage military officers from too long loyalty to congressional committees.

• The press policy will be "open door," but whether this can be best implemented in regular press conferences has not been decided. Sen. Russell added that the individual service reformers officers be contained under this constraint.

secretary of defense for public affairs.

• McNamara, Vance, Hays, Schlesinger and

• No major organizational change will be made until there is a "check in full." Questioned on the Pentagon management plan aimed at further defense reduction (AWD Dec. 12, p. 16), Sizer said he had not read it, while Connally and Zakaria said they had not studied it sufficiently to draw conclusions. Gilpatric, a member of the Pentagon group that worked out the strategy, supported by Kennedy and that although he agreed to its recommendations, he would accede to any decision made on reconsideration by McNamara.

• In conference with Secretary of State Dean Rusk, McNamara said it had been agreed to expand to the maximum "automatic reassignments at all levels" between the two departments.

• Modernization of the ground forces and providing outfit for mobility will be one of his first major projects, McNamara said.



Vertol Proposes Advanced Helicopters

Vertol 107 V1 with two General Electric T55s (1,400 hp) would be chosen up to order at 178 lb. compared with 135 lb. for Model 107 B. rotor blades would have increased chord. Gross weight would be 19,430 lb., payload 5,025 lb. at 25 passengers. Landing roll stops on equipped Vertol Chertok YTC-107 (P) would add weight but increase to more than 100 lb. to 127 lb. Gross weight would be 13,500 lb., up from 11,500 lb. weight of 12,000 lb. Desert operating units would drop from 5.1 tons per unit to 4.9 tons.



Seaborg Is Named to Head AEC; Elvis Stahr to be Army Secretary

Washington—Nathan E. Seaborg was named administrator of the Federal Atomic Energy Commission as John F. Kennedy continued to staff his new administration with top appointments. His appointment was announced by the President last week.

Earlier, Dr. Glenn I. Seaborg was named Atomic Energy Commission chairman and Elvis J. Stahr was appointed Army Secretary, along with three other top officials in the new administration.

Joseph Clark was named as assistant secretary of the Air Force. Before he became under secretary last year, Clark served in USAF assistant secretary for research and development.

James H. Watson was appointed as assistant secretary of the Navy for research and development, a post he has held since 1959.

Thomas D. Moore, assistant director for intelligence and organization of the Budget Bureau, is assistant secretary of defense for supply and logistics. John S. Garfield was appointed as assistant secretary of the Air Force for financial management, a post he has held since 1954. Before that he was deputy comptroller in Defense.

Nathan S. Seaborg, former deputy director of the Foreign Operations Administration, was named assistant to the secretary of defense for legislative affairs.

Nels A. Lemons, who served as public affairs assistant to Treasury Secretary Anderson in the previous administration, was appointed deputy to Assistant Secretary of Defense for Public Affairs Arthur Schlesinger.

J. P. Rouse, who has been assistant director for air defense in the Office of Defense Research and Engineering, was named director of the Advanced Research Projects Agency.

Bernard C. Lovelatt was named for membership on the Defense Reorganization Board. A former governor of Iowa, Lovelatt was an unsuccessful candidate for the Senate last year.

John F. Hume is to be administrator of the Small Business Administration. He has been administrative assistant to Sen. John Sparkman (D-Ala.) chairman of the Senate Select Committee on Small Business.

George Docking was named a member of the Export-Import Bank board of directors. Docking was defeated

for election in the last election in his native Kansas.

John S. Glenn, Chicago Electrician Association president and legislator, was appointed administrator of the Veterans Administration.

Habib, 45, is a lawyer and currently is secretary and treasurer of Annapolis Corp. He received his private pilot's license in 1951 and became an Army Air Force instructor in 1949. He flew as Lockheed test pilot in 1947-48 and a Navy test pilot in 1949-50. Habib founded the Navy's test pilot school and was its first chief instructor. He flew the B-47 P-28, the first U.S. turbo-propelled aircraft, and in 1949 he was the first U.S. pilot to make a continuous circumnavigation of the globe.

Having the State Department in 1946 as his first chief instructor, Habib then became deputy assistant secretary in Defense Secretary James Forrestal. He was first chairman of the NATO military production and supply board and helped plan the U.S. response. He was assistant to the Economic Cooperation Administration chief in 1950, then assistant secretary of defense for international security affairs in 1952-54.

Habib's predecessors have been a mixture of military and civilians, vice chairman of the White House Facilities Study group, consultant to White House situation officer E. P. Carter and a member of the Rockefeller Brothers Foundation study panel.

Dr. Seaborg, University of California chemist, has long been active in the nuclear energy research field. He was a key figure in the discovery of fissionable isotopes which helped to make the atom bomb possible. It was work in this field which won him the Nobel Prize along with Dr. Edward M. McMillan, in 1951.

From 1946 to 1950 he was a member of the AEC general advisory committee and from 1947 to 1951 a member of the National Research Council's committee on standards and units of radioactivity. He also was a member of Senate Ad. Hoc Committee.

Dr. Seaborg is a member of the board of directors of the Nuclear Science and Engineering Corp. of Pittsburgh. Chairman of this board is Eugene Zerger, now secretary of the Air Force and former member of the AEC.

Army Secretary Stahr, who has been assistant at the University of West Virginia since 1939, graduated from a New York college before serving into the field of education. During World War II, he was commissioned a second lieutenant in the Army, and when he was discharged in 1945, he was an artillery lieutenant colonel. During the Korean War he was special assistant to Secretary of the Army Frank Pace.

Two B-58s Set 6 Speed Records; One Breaks 5 Soviet Speed Marks

By William S. Reed

Edwards AFB—Six world speed records were established by two Convair B-58 Hustler jets over a 1,000-lap (521.7-mile) race held near the airfield on July 11. Three records broke marks set by Strategic Air Command jets from General AFB, Tex., earned a 7,000-kg (14,110 lb.) load. A top speed of 1,418 mph was recorded by one of the Mach 2-plus bombers during the run.

The first B-58, flown by Maj. H. E. Cook, topped DoD's records around the 1,000-lap course in 1:00:00.00. The second B-58, flown by Maj. H. E. Cook, topped DoD's records around the 1,000-lap course in 1:00:00.00.

The records established by Maj. Cook in the second B-58 in the 1,000-lap course are:

- Speed with no payload, 1,254.73 mph. Previous record was 1,118 mph set in a USAF McDonnell F-101 in April, 1959. Average groundspeed was 1,150 mph.
- Speed with 1,000-kg payload, 1,254.73 mph. Previous record was 1,118 mph set in a B-58 in October, 1959.
- Speed with 2,000-kg payload, 1,254.73 mph. Previous record was 1,118 mph set in a B-58 in October, 1959.

For the 2,000-lap course, the following records have been claimed:

- Speed with no payload, 1,061.583 mph. Previous record was 990.47 mph set in a Russian Tu-124 last April.
- Speed with 1,000-kg payload, 1,061.583 mph. Previous record was 990.47 mph also set by Russian Tu-104.

The 1,000-lap record set by Maj. Cook is the first in the 1,000-lap record set by a B-58. The first B-58 to set a record in the 1,000-lap record set by a B-58 was the first B-58 to set a record in the 1,000-lap record set by a B-58.

Both B-58s were in combat on September 1959 but have been grounded for the speed tests. Orders and aircraft were from Strategic Air Command's 4th Bomb Wing at General AFB, Tex. A weapons pod was carried in both craft throughout the run.

ATT Satellite Planned

Washington—American Telephone & Telegraph Co. got Federal Communications Commission's authorization last week to conduct a trial space radio communications experiment that will include launching of an artificial satellite. Voice telegraph signals will be relayed from Montreal, N.E. to England, Germany, and France. National Aeronautics and Space Administration is to launch the satellite at end. ATT's long-range plan is to provide a satellite network for long-range space communications. The run just will be the first commercial use to have a satellite launched by the government.

•Speed with 2,000-kg payload, 1,254.73 mph.

The 2,000-lap record was established on July 11 when two Convair B-58s broke marks set by Strategic Air Command jets from General AFB, Tex., earned a 7,000-kg (14,110 lb.) load. A top speed of 1,418 mph was recorded by one of the Mach 2-plus bombers during the run. The second B-58, flown by Maj. H. E. Cook, topped DoD's records around the 1,000-lap course in 1:00:00.00. The second B-58, flown by Maj. H. E. Cook, topped DoD's records around the 1,000-lap course in 1:00:00.00.

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News Digest

Veatch Associates has been awarded a \$100,000 contract and Douglas Aircraft a \$92,000 contract to study feasibility of launch vehicle operations. The National Aeronautics and Space Administration studies (AW No. 7, p. 20) are due in its monthly Packard

Bell has a \$1 million NASA contract to develop the Saturn automatic clock-out system.

Nuclear-powered aircraft Long Beach will be tested with Polaris reactor in addition to the Titan and Triton as defense and Atomic energy research are being carried out.

United Systems Corp. has been named to act as prime contractor and system manager for the Strategic Air Command C-11. The firm, an Air Force subsidiary, is a subsidiary of General Corp. of America, which has been awarded a "subcontract" contract by General Technology Research Corp.

Manufacturers of Long-Term Electronics, Inc., and Chance Vought Corp. may be doing the test for a new jet engine. Long-Term has acquired a "subcontract" contract by Vought Aircraft, reportedly a holding of 15-16%

Douglas Aircraft Co.'s board of directors reported a fourth quarter net profit of \$2.5 million for the third 1960 on total sales of over \$1.7 billion. The fourth quarter profit reflected the company's net loss in 1960 to \$19.4 million representing \$5.99 per share. Last year's loss was \$33.5 million or \$5.86 per share. Douglas will transfer its foreign activities from the Santa Monica facility to its production facilities at Long Beach in May 14, as part of the company's program to consolidate foreign activities.

Miss Baker resigned last week as assistant staff director for the Senate space committee, to become director of defense, business development for Radio Corp. of America, its headquarters in Washington.

Transpacific Denial

Washington—President Eisenhower's approval of a Civil Aeronautics Board decision on the Transpacific Route was to take last week and denied the Board not to grant additional routes on routes to the Far East because of possible safety hazards on foreign airlines. Using high cost capacity of jet transport coupled with limited facilities pointed out the route as not feasible for carrying additional service across the Pacific. Eisenhower's decision was a final, unreviewable decision to the White House by United States Civil Aeronautics Board (AW No. 7, p. 40). He also recommended no additional service increase the scheduled on the Pacific until another Board review of Pacific routes was not a case from new airlines which another airline is needed on the route.



NEW 33 ELEMENTS and four drive systems, recently installed at National Aeronautics and Space Administration's Wallops Station, will be used for balloons. The 40-ft. antenna, which moves in azimuth and elevation, was produced by CSR Electronics Corp.



Douglas Turbofan-Powered DC-8-50 Design Details

First Douglas DC-8-50, now undergoing flight tests in Long Beach, Calif., is shown with its 17,000-lb. thrust Pratt & Whitney JT-9D-3 turbofan engines. Engine pods, redesigned to accommodate the installation, are 218 in. long, 56.5 in. wide and 71.5 in. high. The air inlet is elliptical, measuring 61 and 46 in. on its major axes. Primary thrust reversal is afforded by turbo-propellers (right) mounted by a pneumatically-actuated sliding control board the long forward thrust reverser and by lateral doors that swing down (left). Fan thrust is reversed by cascade air at the fan discharge at either side of the engine. Fan reversers are mounted by longitudinally mounted lower doors. For reverse thrust, the lower doors are opened (right) and the reverse cascade air stream flows in place in the fan discharge stream. The DC-8-50, with greater range and improved takeoff performance, has been ordered by United Air Lines KLM (left) and Aeromexico de Mexico.



Prospects Dim for Transport Department

By L. E. Dots

Washington—Growing pressure for tighter control over federal regulatory agencies is now expected to bring about a revamped U.S. national transportation policy but chances that a proposed Department of Transportation will be created at cabinet level under the Kennedy Administration appear slim right now.

The recent issue of mixed studies of regulatory agencies (AW Jan. 9 p. 41) will make congressional change, and an emphasis of the situation during the next session of Congress but it is now generally believed that any legislation calling for a drastic revision of transportation legislation will meet with strong congressional opposition.

The fact that the Executive Office of the President will plan a large part in the advancement of particular administrative programs should not be confused with a lack for a class of executive agencies for transportation.

Whether, in planning or in the execution of private, a matter of local public concern and the Congress has its duty to discuss and to vote. The Executive Office must be the first to move, and the Congress must be the first to move. The Congress must be the first to move. The Congress must be the first to move.

May Spur Coordination

One major effect of the Kennedy Executive Order is the demand for close coordination between agencies regulating the various modes of transportation. For the purpose of strengthening U.S. transportation facilities under a unified operating policy.

President Eisenhower stated new steps for programs of a unified transportation approach. The new approach is to be a unified approach to transportation. The new approach is to be a unified approach to transportation.

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included in our regulatory transportation structure. The Lands position undoubtedly has Kennedy's support and it can be expected that the Lands-managed evolution of a new transportation policy will be backed by the new President. This process will be closely monitored by Congress.

Overcoming inevitable congressional fears that the White House may be increasing too much control over regulation agencies and the development of transportation policy, Lands had this to say in his report.

The fact that the Executive Office of the President will plan a large part in the advancement of particular administrative programs should not be confused with a lack for a class of executive agencies for transportation.

Whether, in planning or in the execution of private, a matter of local public concern and the Congress has its duty to discuss and to vote. The Executive Office must be the first to move, and the Congress must be the first to move. The Congress must be the first to move.

The fact that both House will probably will maintain, spend and make it under, strengthen White House control of regulatory agencies leads many observers to believe that the long-term objective of the Lands position which will be for legislative changes, then executive agencies. The Executive Office must be the first to move, and the Congress must be the first to move.

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the overall industry would give them a dominating role within an executive department.

Although truckers had not filed a line stand in the same order last last week, John V. Kennedy, managing director of the American Trucking Assn., told in a Chicago speech that if sweeping changes in economic or government regulations, then it must be concluded that he won the executive branch, the Congress the regulatory agencies, the courts and all of us in the transportation business have been a bunch of methods.

ATA Position

Stuart G. Tipton, president of the Air Transport Assn., takes the following position.

We do not propose to get ourselves involved in one party membership and unilaterally transportation package. Whether that package be in the form of a private transportation statute or in the form of a single government regulation, both for all transportation, in fact, we can not take that kind of step.

The fact that Congress had rejected the question of trucking more than 20 years ago and rejected the idea of establishing independent agencies to encourage, promote and develop a strong air transport system. The fact that Congress had rejected the idea of establishing independent agencies to encourage, promote and develop a strong air transport system.

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B-1B's Connect Moscow, Magadan

Moscow—Landing of an Boeing B-1B at Magadan marked the beginning of regular direct service on the 1,700-mile route Moscow to Magadan. The airport, Magadan, on the coast of the Sea of Okhotsk in the northeastern Soviet Union, is considered by analysts with many remote parts of the Soviet Arctic and the Chukotka Peninsula.



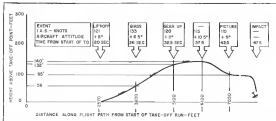
"Scratch the contact—it's a whale."

The U. S. Navy's job of protecting its from unknown attacks is never easy, and the task alone, supplied by nature alone, is all the more difficult. Every day must be investigated. What proves to be a whale today, may be an enemy submarine tomorrow. Vought Associates is working with the Navy now in the development of technically advanced equipment designed to detect the enemy positively and leave him no escape. New aircraft for the most efficient use of new electronic search equipment, advanced sonar systems even space systems, are under development by Associates and its sister divisions. They are part of a family of new extraordinary warfare systems which would converge from the sea, air and space to join down the enemy sub.

**CHANCE
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**AERONAUTICS
DIVISION** DALLAS, TEXAS



PROBABLE flight path of Eklite was reconstructed by operations group of Civil Aeronautics Board using photographs with all of two photos graphs taken at Daniel's Eagle International Airport while plane was in the air. The photos showed following of No. 1 engine after run and closed, subsequent loss of power on other engine or engines. At impact, three engines had almost full power.

Crash Spurs Further Bird Ingestion Study

By Glenn Garrison

Boston, Mass.—Crash last Oct. 4 of an F-4 Phantom II fighter jet, which crashed into the Atlantic Ocean, led to a study of the flight safety effects of multiple bird strikes. According to a Federal Aviation Agency statement at a recent Civil Aeronautics Board hearing here (AVW Jan. 15, p. 35).

There J. Briggs, TAA project engineer in charge who was project engineer for certification of the Eklite's Alcon 501 D-13 turbojet engines, advised counsel at the public hearing that the crash that previous tests had not considered the operating effects of bird strikes into the engines. As that time Briggs said, it had not been considered that more than one engine at a time could be affected by birds. In past damage tests before the 1972 test facilities showed the engine has the structural strength to withstand direct impact, he said.

The new test program will get under way within a few months, Briggs said, and will attempt to find results of preventing ingestion and of minimizing the effects of ingestion.

Bird Control

Another FAA program connected with the bird hazard has been initiated since the accident, according to this source. One of the agency's test engineers, James M. Loefer, Air Commerce Operations Specialist, said he had been assigned to a bird control project since mid-October. Previously, he had been no FAA personnel had been responsible

for coordinating the control of birds on airports, although assistance and advice had been provided by TAA.

Considerable attention at the three-day hearing was directed to bird strikes and their possible effect on engine performance. Bird strikes on the engine in following the accident and bird remains in three of the four engines attached to the aircraft indicated that a crash was related to the loss of one of the Eklite's engines and possible to the apparent power reduction on an additional engine or engines.

Visibility Loss

Another bird strike effect that received attention at the hearing was the possible loss of visibility by windshield wipers. The crash of an Eklite F-4 Phantom II fighter jet, which crashed into the Atlantic Ocean, led to a study of the flight safety effects of multiple bird strikes. According to a Federal Aviation Agency statement at a recent Civil Aeronautics Board hearing here (AVW Jan. 15, p. 35).

There J. Briggs, TAA project engineer in charge who was project engineer for certification of the Eklite's Alcon 501 D-13 turbojet engines, advised counsel at the public hearing that the crash that previous tests had not considered the operating effects of bird strikes into the engines. As that time Briggs said, it had not been considered that more than one engine at a time could be affected by birds. In past damage tests before the 1972 test facilities showed the engine has the structural strength to withstand direct impact, he said.

On the closed engine No. 1 engine had been feathered and only No. 1 engine had been pulled.

The actual amount of power available to the pilot of the aircraft plane was a subject of some disagreement at the hearing. According to a reconstruction of the probable profile of the 47-foot flight a small aircraft was followed by following of No. 1 engine and then to additional power loss from engine failure, progressive power deterioration or deliberate reduction on operating engines to maintain directional and lateral control.

Subsequent to the loss of No. 1 engine, the aircraft was controlled by the CAB Operations Group of aircraft test power available would the engine lost of 1,500 hp, or the effective power of one engine at reduced power. The test aircraft could have been spread over many combinations of operating engines. Beyond the point at which the aircraft was thought to have stalled, almost full power had been used on three engines by the time of impact.

Alcon Test Findings

However, B. W. Helle, head of Alcon's department of test projects, said operations test engines on the turbojet to the 1,100 available horsepower figure Alcon had reaction tests, along with analysis of the amount of bird material found in the Eklite's engines, indicated that considerable more power was available. Helle said whether this power was used or not is another question.

The flight path was reconstructed by



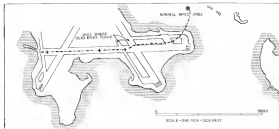
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OPERATIONS group's reconstruction shows probable course of plane, including turn to left, fragments' recovery of landing.

the Operations Group with the aid of two photographs taken near the site within of Runway 9, which run the Eastern Island runway, and Runway 18, at Logan International Airport.

Photographic Evidence

These photos were made by North-east Airlines Capt. Charles Jones and M. A. Williams, both amateur photographers, who happened to be taking pictures at the site. The investigation, using engineering data and assistance provided by Lockheed Aircraft, revealed the flight path of the aircraft during the portions of the flight that was estimated to be 140 ft.

In the first photograph, the Electra was reported to have shown a 9 deg. nose-up attitude, altitude of 110 ft. above the water level, magnetic heading of 30 deg., normal bank angle of 5 deg. left. The No. 3 propeller was feathered. In the second photograph, apparently taken a split second later, the aircraft had moved about 100 ft. along its flight path, nose-up attitude had increased to 9 deg., bank angle had increased to 5 to 7 deg., and heading was about the same. Both photographs show a dark wedge-like formation above the runway which some specialists have attributed to the presence of a flock of birds.

Engine Analysis

Analysis of the photographs group indicated that there was no evidence of mechanical malfunction in any of the engines at their respective times. Engine No. 1 showed evidence of bird fragments in internal and external components. Evidence of bird matter was found in the third manifold air duct in the fifth stage, indicating, according to the report, that this might be a possible reason for propeller feather-

ing. Negative investigation of 875 ship was indicated at impact.

On No. 2, internal and external components indicated bird fragments. There was 3.115 deg. at impact. Propeller blade angle at impact was about 79.4 deg.

Engine No. 3 was developing 3,310 hp at impact. No bird fragments were found in internal engine components. Propeller blade angle at impact was about 79.9 deg.

Engine No. 4 showed evidence of bird fragments in internal and external components. At impact, there was 3,515 hp. Propeller blade angle was about 47.1 deg.

Subsequent to the accident, Allison performed a number of repetitive tests to determine the effect on performance of multiple bird strikes. Tests indicated that 2 to 4 lb. birds were used as the tests in quantities of one to eight birds. Integration of one bird. Tests indicated that one bird. Tests indicated that one bird.

On the occurrence where four birds were ingested, the test engine required only twice the fuel and that in one case where the engine screws were not immediate, an overhead condition resulted that would have burned out the turbine blades had the engine not been shut down quickly. In fact, the turbine of the crashed Electra's engine showed no signs of overheating, but, he said, it could be concluded that these engines met the conditions when, according to him, were not made.

Service engines accelerated by Allison have not shown any signs of bird damage externally. He noted that of the 500 tests involved, several tests showed evidence of bird fragments in the oil system from quick engine

shut-downs, but never made the engines.

Although this was not brought out in the testimony, Allison believes that only two or three birds went through one of the Eastern Island's engines. This is based on the amount of bird matter found in the engines, and would have resulted in a two- to three-second loss of power by Allison's calculations.

Allison Exhibits

Allison submitted exhibits based on its test program in which a probable loss and reason of three pattern was plotted. The tests, assumed that at 25 sec. from start of takeoff roll, anti-icing is initiated on one engine and at the same instant two of the other engines ingest three small birds simultaneously.

From a point of 55,000 lb. thrust, nose up and nose down, at takeoff, thrust was dropped to 27,000 lb. and dropped to 135 lb. at the 25 sec. point. At 27 sec. thrust reached its lowest point, 11,000 lb. At the 30 sec. point, there is a surge to 75,000 lb. of thrust, and by 34 sec., thrust has leveled off at 18,000 lb.

A second curve assumes the auto fueling of an engine and feathered blades three seconds apart on two other engines. In this case maximum thrust point is 16,000 lb., reached at the same 27 sec. mark, and recovery to 18,000 lb. is at the 34 sec. point.

Flight Tests

The Lockheed flight tests were described in testimony by C. K. Myers, engineering flight test department manager at Lockheed and a member of the CAB operations group.

One of the 500 tests involved maximum asymmetric power conditions at 115-120 kt. of airspeed with two



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engines out and at various bank angles. The results of the test, Messer is positive, showed that if the two left engines of the Electra had failed, it would have been necessary to reduce power on the right engines to a combined total of a single engine at full power to retain control of the airplane. With the wing level and power equally distributed on the two right engines less than 1,000 ft. could be used on each right engine. But if full power was applied to the inboard engine and zero power to the outboard, control of the aircraft would be maintained at and above 115 ft.

The Lockheed tests also resulted in detail the effects of various horizontal and banked conditions. One purpose was to simulate complete electrical or hydraulic failure which would result in an inoperative control boost system, and to determine whether the Electra could be controlled in a banked condition with a failed engine even to the point where bank shifter to neutral. During these tests, directional control in terms of rudder force was the limiting factor. No particular difficulties other than fairly high forces existed in maintaining or closing bank angle.

Messer indicated, however, that he believed a rudder boost of minimum was not related to the accident.

Testimony at the hearing provided no evidence of rudder failure.

The position of the boost control handle, however, came in for question during testimony by Capt. Frank Kress, Eastern's director for flight crew training.

This control is placed near the captain's seat, and to use it, he must reach down and open its cover. After the accident, Kress testified Eastern ran several lessons three times over during which and handling, but decided against it.

Eastern has changed none of its cockpit emergency procedures since the accident, Kress testified. He was questioned regarding engine out training procedures both in the simulator and in flight.

An item in Eastern's flight manual that came in for questioning calls for emergency engine out training procedures, but the engine out training procedures only in the simulator and in flight.

Decision on Midair Collision Cause Hinges on Setting Time of Impact

By David H. Hoffman

New York—Probable cause of mid-air collision here will remain unknown while investigators conclude their investigations. Time sequences linked to events preceding the crash.

After questioning 27 witnesses during an eight-day public hearing here, representatives of the Civil Aeronautics Board, the Federal Aviation Agency, United Air Lines and the Air Line Pilots Assn. agreed that the crash still did not resolve.

• **Why the pilot of United's DC-8 Flight 505** crashed here, but cleared land at a 45 ft.

• **Why radar controllers in the New York Center failed to advise the jet's high move beyond 175 ft. and near the pilot's path.**

According to Ronald DiGiuseppe, a controller possible for the DC-8 in the sector of Boston Center's transmission "under review, transmission was made at 10:43:10.20 EST." At the instant of this transmission, DiGiuseppe stated, the jet's high was "one to three miles southeast of Peoria" and still heading toward the jet.

DiGiuseppe's timing of his transmission seemed suspicious since Charles F. McElreath, the president of United Air Lines, brought out that the jet's flight recorder had indicated the collision took place 11 mi northwest of Peoria at 10:43:12.85T. This timing of the accident was substantiated in a dispute by CAA's interpretation of a recorded pilot-controller conversation which dated the collision at 10:43:13.44 EST.

At the time of the hearing it was apparent that neither investigation would be required to pinpoint the DC-8's position during the critical minutes just prior to the crash. But it was also clear that both DiGiuseppe and the flight recorder could not be right. For if the jet was one to three miles northwest of Peoria at 10:43:10.20, it would have had to make good a gain of about 1,500 mph to reach the collision site at the time indicated by the flight recorder.

The manner in which this conflict is resolved, FAA sources told Aviation Week, may decide whether CAA is seen as a contributing cause leading to the crash after all evidence has been collected. That such a finding was a major objective of United Air Lines was borne out by the statement read into the official record by McElreath just as

the engines stopped. In it he said: "I'm dead."

At this time we think it can be safely said that the accident would not have happened had Air Traffic Control properly advised the equipment, personnel and facilities involved.

Ernest R. Quasada, FAA's outgoing administrator, separately took a different view. In requesting CAA to acquire about 40 flight recorder tapes from airlines using Peoria prior to the crash, Quasada said that data extracted from this recorder on board Eastern's DC-8 gives reason to believe that some pilots may have been engaging in "unsafe operating practices."

That Quasada said has excluded radar, the most serious cause of the accident because it believes those "operating practices" may call for changes in the overall air traffic control system. Or, on the other hand, possible driver pilots' actions against airlines and pilots for violating existing Civil Air Regulations may result, he said.

Almost certainly CAA officials here stressed the hearing will be reconvened at a later date. Meanwhile, they said, the record will remain open and accessible. Only after the record has been closed will the full members of the CAA study the evidence and reach a conclusion on the cause of the crash.

In informal conversations, however, revealed that the investigation has intended the agencies that this ultimate record must establish at least one of two points in order to help decide the DC-8 pilot for contributing factors. A significant interpretation of the part of the record concerning (VOR) said by the pilot to clear the intersection was, one (AOI) Jan 16, p. 10.

The other, for more complex ground control, was the position of the jet's progress to and then beyond Peoria. But before anyone can even be considered a causal factor, they must be proven to be probable cause to prevent the accident.

• **Collision occurred** substantially at the time and at the place indicated by the flight recorder. This would not doubt open the controller's statement.

• **DC-8 was being** allowed radar separation at the time its pilot was advised "under service" as terminated contact later by Approach Control.

• **FAA requires** center controllers to warn pilots of aircraft under their surveillance of possible dangerous situations before transferring the control to another facility. Such a warning was never received by the DC-8.

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AIRLINE OBSERVER

► The Netherlands will make another attempt to bid for a Los Angeles route for KLM now that the new administration has taken office. The Eisenhower Administration, according to Dutch sources for the trade, agreed last month to approve the Los Angeles terminal point but was stopped short by a Treasury Department warning that the present unallowable U.S. balance of trade would be disrupted further by the granting of air routes to foreign flag carriers. The Dutch proposals stipulated by forwarding figures to the U.S. showing that KLM's gross deficit in the U.S. then it takes out and will use these figures as the basis for their renewal campaign for the route.

► Riddle Airlines inaugurated Logor service last week with the first of several Aerostar Whetworth 616 Argosy long-range transports it has on order. The aircraft is certified on the basis of 36,000-lb maximum gross weight, basic operating and 50,000-lb maximum landing weight. Average stage length along the Logor route pattern flown by Riddle is 230 miles. The fully fueled Argosy, which averages 240 lb. along these routes, offers economic penalties on initial segments since all fuel weight in excess of the 30,000-lb landing limit must be burned off prior to landing. For flight planning, Riddle assumes the aircraft will burn 3,000 lb. per hr. in cruise, 2,600 lb. in climb and 200 lb. in descent. Cruise is scheduled 36 min. for most en route out-loading and off-loading stops.

► New heliport being completed at Baka on the Caspian Sea coast will be the base for flights to Rome's 58 passengers (including 1000 lbs. of cargo) in 1977. The 36-in. km. long airbase is setting world records, but its projected introduction into passenger service has long been delayed. Baka is one of the Soviet Union's most commercial helicopter hubs. During the first half of 1969, helicopter flights made 1,000 flights and carried 16,000 passengers between Baka and Nefteyevsk, an oil-producing center built on pilings over reefs in the Caspian Sea.

► Federal Aviation Agency team have demonstrated that crew communications on transport aircraft can be effectively recorded during flight through the use of an area pickup microphone with a corded pattern. Tests show that when a microphone is mounted on the instrument panel, adequate protection is afforded by noise shield and vibration isolation and that ambient noise levels are not affected by the use of electronic noise filters.

► International Air Transport Association is conducting a survey of international clearance conditions on the Far East in its latest drive to cut red tape in border nations and streamline procedures. Purpose of the survey is to determine how far countries have gone in adopting clearance recommendations made by an intergovernmental conference held in Rome last year under the auspices of the International Civil Aviation Organization.

► Philippine Air Lines has purchased a twin-engine Valiant Viscount from Capital Airlines for operation on its domestic routes. The carrier currently operates a fleet of four Viscounts and two Fokker F27s in addition to piston-engine aircraft.

► Federal Aviation Agency has set uniform standards for identification marks on fuselage, wing, and tail, requiring markings at least 12 in. high on the side of the fuselage or on the vertical stabilizer. Wing marking will no longer be required. Aircraft operators have until Jan. 1, 1966, to comply with the regulations, although all aircraft which are introduced or newly installed after Jan. 1, 1962, must conform to the new standard.

► American Airlines will launch its Saline Recreation Center in Bristol, Maine, Waterville Center, New York late this year. Saline, an electronic data processing system that will handle 7,500 passenger reservations per hour, will be linked with 1,100 reservation desks in over 60 cities by mid-1963. The system will enable Americans to process \$5,000 daily phone calls, 50,000 daily requests for fare quotations, 40,000 daily reservations, 30,000 ticket sales and 30,000 daily interline transactions.

SHORTLINES

► Air France has increased its Boeing 707 jet continental service between New York and Mexico City from two to four flights weekly. The route previously had two 707 and two Lockheed L-649 Constellation flights a week.

► British Overseas Airways Corp. reports a New York-Rome passenger load factor increase of 27% for December, compared with December, 1969. The British carrier flew 3,193 passengers over the route last month and reports all-year loadings for January and February indicate the load factor will increase again.

► Coastal Eagle America (Bonnard), Ltd., has become a member of the International Air Transport Association and, under Acceptance of Conditions, which has limited international operations, has dropped out of the association, leaving the total membership at 59.

► Delta Air Lines is scheduled to start direct Douglas DC-7 service from New Orleans to Los Angeles, N. W. 1, Feb. 1 with three weekly flights. The aircraft will operate via Memphis, Tex., Jackson, on two flights and Atlanta and Memphis, Ga., on the third, and all three will terminate in Chicago.

► Eastern Air Lines has received Civil Aeronautics Board permission to delay the start of this month trip service between Baltimore and Tampa/St. Petersburg, Orlando and Louisville until Feb. 1 to allow the airline to complete operational arrangements at Baltimore's Friendship Airport. CAA and Eastern must operate the services on the Washington-Baltimore segment of Service Ten en route to Detroit.

► Federal Aviation Agency has started construction of its new \$1.75 million air traffic control center building at Falmouth, Col. The 50,000 sq. ft. structure is scheduled to be completed in a year, with an additional two months required to install 55 radars and 100 electronic equipment. Construction will house 100 air traffic controllers and electronic specialists.

► Mohawk Airlines has been denied permission to fly from Buffalo to Detroit on a weekly basis by the Civil Aeronautics Board. The Board and it would be inappropriate to grant Mohawk nonstop rights over the route while the regional Line-Detroit Association is still pending. The nonstop rights requested by Mohawk would have eliminated Line on all but three flights in each direction on the route.



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DE HAVILLAND AC-1 Caribou STOL transport can carry 30 combat troops or 3 tons of cargo, has maximum range of 1,400 mi.

Aviation Week Pilot Report

STOL Caribou Calls for Special Handling

By Larry Booth

PT. RAYLE, Me.—De Havilland AC-1 Caribou is a simple, rugged twin-engine transport which is light on the runway and honest in its response—but its STOL capability calling for flight as much as its low stall speed holds some surprises for pilots used to flying higher performance aircraft from long runways.

The Caribou is under evaluation here by the Army as a medium-size transport which can carry a substantial load in short takeoff and landing operations on rough terrain. It uses a combination of conventional high-lift, high drag devices rather than airfoil features to get its STOL performance. The AC-1 has a rugged structure similar to that of a cargo aircraft, and it is designed around power systems and components to provide a high degree of reliability.

De Havilland Aircraft of Canada originally planned the Caribou for operations from unimproved airstrips in northern Canada, but the U.S. Army became interested and ordered five transporters for testing. A recent order brings the total to 31 and will cover production



CARIBOU transport can handle cargo loads up to the size of an Army Jeep vehicle.



CARIBOU wing has a dual section flap arrangement shown extended. Forward part of the upper wing surface also is shown, as is the slanted and extended outboard wing leading edge and leading gear details.

through 1961 at first month's receipt.

Aviation Week flight evaluation of the Caribou was performed at Cannon Air Base here, some of the first program. Army testing has included flights from short, rough, dusty and muddy strips, and flights were made under desert conditions at Yuma, Ariz. Cold weather tests are currently under way in Alaska.

The Caribou's high wing has a 98-ft 4.75-in span, fuselage is 22-ft 3-in long and height to the top of the vertical stabilizer is 31 ft 9-in. The large vertical tail, designed to provide adequate control at low speeds, is a distinguishing feature of the transport.

AC-1 is powered by two Canadian Pratt & Whitney R2800-11 engines with Hamilton Standard 61D90/7107-4 three-bladed, full feathering propellers. One test aircraft has seven pitch propellers for evaluation, and this feature may be ordered for operational models.

Commercial version of the Caribou has two K1600-7MD engines. The R2800 was produced in large quantities during and after World War II for military and civil versions of the Douglas DC-4, and long experience should make it a highly suitable engine to maintain and repair for both military and commercial use.

The AC-1 is operated by the Can-



CARIBOU can operate from short, unimproved fields or improved fields with leading strips.



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SLIPKNOT does panel under automatic panel for T-100 turboprop. ST-100 ARC-119 runs a VOR receiver. ARC-119 makes beacon, as ILS. ST-100 receiver and dual receiver.

tion Department of Transport and the U. S. Federal Aviation Agency for transport operations with two pilots at a maximum gross takeoff weight of 75,000 lb. Operating limitations for flight requirements for commercial operations are provided in the flight manual. The aircraft is designed to provide safe single-engine operation and for gradually accelerated climb operations.

Military Difference

Military operation however takes full advantage of the aircraft's STOL characteristics. The turboprop is designed to take pilot can fly in clouds. Quick over-approach to maximum flight would make pilot operations become marginal.

A pilot used to flying from long, gravel runways and landing with a significant speed reserve over the stall speed will find flying the Caribou a really different experience. The aircraft's full performance, takeoff and landing techniques, such as holding the approach indicated airspeed close to the stall speed. Any padding of pressure and approach speed with the Caribou can cause more trouble than flying with the stall speed.

Takeoff and landing technique with the Caribou is different. When the stall speed is reached, the pilot is to go straight ahead as fast as possible, either takeoff or to obtain a steep approach path and proceed flaring after flaring in landing. Extra speed could cause a dangerous overspeed into rough or wooded terrain.

Short takeoff and landing aircraft in the light plane class are not rare. The post-World War II, General built Piper PA-180 Stearman had a maximum speed of 31 mph and normally landed at 10 mph and several other light STOL aircraft have been flown since then. But application of STOL characteristics to a

large, multi-engine transport is also new.

The Caribou's high-lift system is mounted on the wing, which tips from a 12 in. chord at the root to 5 ft 8 in. at the tip of the curved wingtip, giving it a 10:1 aspect ratio. Wing area is 712 sq ft, 267 sq ft of it devoted to the high-lift area.

High-lift device is basically a semi-rigid flap system in which two flap sections span the trailing edge of the wing from root to tip and flexibly to follow. When the flap is up, the flap sections are held down by three internal approximately 90 deg. The aft end of the flexible device with the flaps to provide drag, and more drag is added by the flaps on the main gear struts to keep forward speed low while the high-lift system is generating lift.

Slits between the wing leading edge and between the two flap sections keep air flow smooth over the flaps. From the root to the flap tip, the flap is 7 ft. From there out the flap sections decrease in both span and standard width. It doesn't just go when the flaps go down but it also responds to control movements.

A better tree job is required in the right outward motion, and ground roll is halved to both left and right without adverse. An automatic entry control that is linked to the right in board motion and provides increased dihedral effect in straight takeoffs at low speeds.

Because of the exaggerated effect on trees when the flap is lowered, there is considerable between the flaps and the horizontal stabilizer which can

Milner Editor Larry Riddle was a naval aviator for 23 years, flying a variety of aircraft from subsonic fighters to multi-engine land and seaplanes. His 1,000 pilot hours include the Royal Air Force advanced instructor's course at the English Central Flying School in 1940, where he checked out as a 34 different RAF aircraft. He holds a commercial pilot's license with instrument rating.

more, through four degrees to compress air for the design, as pitch limits.

A fence to induce spanwise flow is on top of the wing 7 ft outboard from the middle at the dividing line between flaps and ailerons. Replacing another 7 ft outboard on the leading edge is extended and drooped slightly. Fences and drooped edge are designed to provide better natural roll turning.

Larger Ensignage

For adequate control at low speeds, the Handford has given the Caribou a larger than usual ensignage. The tail fin for example has 60% more surface than the DC-7 tailfin.

The RC-119 can be dropped to a launch of maximum and 5,000 ft. In climbing, roll and yaw. It can carry 22 soldiers, but air drop or ground delivery. Jump is made through the rear cargo which also is used for loading.

Caribou has two air side doors, but there is not enough space to permit ground ramping through them. Inside cargo is provided because it is necessary to use to aerial delivery and can be easily replaced. Caribou also can



COCKPIT view shows pilot and copilot instrument panels, engine gauges and fuel control. Sliding floor panel is center console communication and controls.

**North American Aviation's
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This is the Division that developed and is producing America's first successful antitank strategy: guided rounds—SAC's GAM 77 Round Dog—and brought it from drawing board to powered flight in just 20 months.

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This *Delephium* is a colonizing vernal in American mostly disturbed open situations.

THIS
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Carbon Specifications

Wing length	90.6 (41 mm)
Wing span	122.8 (56 mm)
Height (Tail)	81.3 (36 mm)
Height (Foot tip)	13.1 (3 mm)
Footprint width	8.6 (3 mm)
Footprint length	28.0 (12 mm)
Culic length, inside	29.8 (8 mm)
Culic width, inside	6.8 (3 mm)
Culic weight	26.908 (3 g)
Empty weight	
Alimentum mass, food, oil and excreta	16.800 (3 g)
Masses of food and excreta	722 g (30 g)
Performance	
Maximum cruise speed, normal	137 km/h
Min. speed in no-takeoff	125 km/h
Max. speed, cruise	74 km/h
(Note: Following flight speeds are for FFA and EXOT approved operations.)	
Military operations shall comply with speeds on text and are explained on text.)	
Stalling speed, gross and flap up	54 km/h
Stalling speed, gross and flap down	71 km/h
Rate of climb, one seat, normal	2100 ft/min
Rate, two engines	1,575 ft/min

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loads on hand 44. as a form of sale

Entering the cockpit from the cabin there is a high step, reminiscent of some plane light decks. Generally, the Caribbean light deck is less cluttered and more airy than most tropical aircraft. Space can be recovered by sliding the tracked aerial electronic selector pod (and) under the instrument panel.

Cockpit Visibility

Each pilot seat and cockpit was an comfortable and fully adjustable. Inboard arm rests are retractable. There is only a slight tendency to hit one's head on deep protrusions on entering a seat. Visibilities from each seat often little more than a gradual increase. The

over the instrument panel is high and forward visibility can be improved only by raising the seat up and adjusting the

There is a small window overhead on each side to improve the side view during a turn, and side windows provide observation of the engine.

Rudder pedals are adjustable together by a crank on the pedestal between them. There need be no concern about the pedals being matched when the rudder is centered, since the pedals track in adjustment together.

As in most high wing configurations, the throttle, mixture and propeller control levers are located in the center of the cockpit seat. This arrangement permits shorter, more direct control linkage with the engine. All engine and control surface linkage can be accessed at such ease.

There are no unusual features about

the two bulke solder points of the W-type wheel control gaskets. Microphone, microphone and silver trim hat tone, we located on each wheel.

- **Overhead console** has throttle, gear, lock, landing gear, mixture, propeller, speed, fuel/air for carburetors and thrust levers, rudder trim and carburetor heat controls, plus switches for systems, landing and taxi lights and collector alternate w.

- Front instrument panel, both pilot and copilot sides, sets Arnes Torsdén for the flight group: upper row has compass, artificial horizon, altimeter, lower row has WGR indicator-selector, compass and AED indicator, vertical speed. On the pilot's side the turn and slip indicator is to the left of the lower row, and on the copilot's side it is to the right.

• **Center panel section** left row has trip to bottom, direct radiator, coolant and air temperature; cylinder head temperature; oil temperature; second row from left has trip to bottom, manifold pressure, tachometer, fuel and oil pressure; third and fourth rows are the same as the two rows on the left. Instruments in the left row for the left engine, and those to the right are for the right engine. Low oil pressure warning lights are also on this panel below the instruments.

- Overhead on the left are the auto-boosting switch and radiator light switch, leading check list overhead on the right is: oil/alt check list and drain indicator light
- Left of the center panel is the fuel control panel to the right of the center panel is the AC-DC power and display panel

* Between the pilot's master pedals are control levers for handbrake, clutch, handbrake, parking brake, handbrake, handbrake, low pressure, lights, hydraulic

*Sliding floor panel h/s the FM for
trial suit. Unit SRC-85 transceiver
with 1,750 characters, 10.5 VDC, etc.

comes, an ADI module, a further beam, a glide slope ILS, a standby VHF T366-A five channel transmitter and a dual instrument amplifier which can be borrowed.

Elevator trim wheel is at the right of the pilot's seat.

Fuel system is designed for simple operation and is well within the capabilities of one pilot. Storage is in two main tanks, one in each of the outer wing sections. Each tank consists of two collector cells and holds 561 gal. All the cells drain by gravity into the No. 1 or subsonic cell where there is a submerged booster pump. Fuel management is so arranged that in normal operation it is a hands-off system, and in emergency conditions any combination can be readily selected.

For the American West collection, the Carlow was fast, light—21,000 lb—and the temperature was 71° Above the 10,000-ft field is 105 ft. Procedures involved in the flights are for military operations and basic hole maintenance in those powered by FFA and DOT for transport operations. Considerable practice is considered necessary to master the AC-1 full performance technique even for pilots experienced in STEM, and.

These steps are done only for the usual pattern of work of selected heavy light vehicles, solving an efficient ground crew work to make use of the specially designed system as is proper under. Because this is the easiest to through, but causing driving personnel is handled with flexibility while speed and position is left out and ground crew have turned through five revolutions for the first start of the day, or they for subsequent starts. Engines on then parallel automatically with the engine on and there is a positive start when neither controls are moved to neutral.

Carsen has an particularly unusual feature in its pet-ion engine and fuel pet-ionoff clutch.

¹ There is a mistake at the end of the



DE HAVILLAND cylindrical slide lead adjuster replaces standard slidebars in the Carlson. Chief advantage of cylindrical type is that it gives a step-by-step indication as loading progresses, allowing possible immediate adjustments of center of gravity or weight and moment limits are exceeded.



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maneuver, lined up with the runway and with both flaps, the brakes are kept on and the throttle advanced until 1900. 100 of manifold pressure and 2,750 rpm are reached. On selecting the brakes, nose-wheel steering is maintained by use of the wheel on the left side of the pilot position.

First Arbitrary Worm flight involved a medium performance takeoff. For the pilot not accustomed to this aircraft, flying speed is reached within a surprisingly short interval. Procedure calls for pulling the valve back all the way, although this runs against normal flying instincts.

If an initial climb speed of 79 ft/sec has been called for, the valve must be kept for it and the nose high, not the 75 ft/sec speed is easily exceeded. Worm proper coordination, lift-off occurs at about 140 ft/sec, a 10 mph headwind. Full performance run is 140 ft/sec, with an end and 118 ft/sec with 10 mph headwind, and a 50 ft/sec obstacle can be cleared in 1,020 ft with an end and in 545 ft with a 10 mph end.

It is during the takeoff that limited control over the nose is needed most, for with the high attack angle and climbing attitude the flow of air is completely blocked.

Takeoff power can be maintained for a maximum of five minutes. Maximum continuous power for climb is 42.5-in. Hg and 2,750 rpm, at sea level, and proportionately less manifold pressure for higher altitudes.

Climbing Speeds

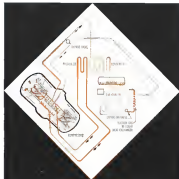
A wide range of climbing speeds is available, because at lower speeds the jet exhaust separator tubes keep cylinders free of temperatures within operating limits. Engine needles have no cool flaps.

For full performance climb-out is left, counter forward progress can be held to a minimum and climb to a maximum.

Optimum climb speed at full load of 26,000 lb and maximum climb is 94 ft/sec, resulting in a 1,575-ft/sec rate of climb at sea level. Optimum climb speeds with lighter weights are lower, and rate of climb is greater. Single engine climb at maximum weight at sea level is 545 ft/sec.

After landing off and setting a random cruise speed of 140 ft/sec, it is speed-of-sight approach that this aircraft is very light on the controls. Although it is not in sight as a Rockwell D-15 class aircraft, longer tip control is still possible in slowest approach. In reaching speed, turn, however, almost full three of the altitude is necessary, and then the rate of roll is slow.

Rapid changes in altitude also require a little muscle on the yoke. However, control pressures are a small fraction



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A/RResearch Aviation Service converts Convair 540s and 440s into high performance, efficient and economic aircraft with Napier Jet-Prop engines specifically designed for the Convair 540.

With over weather cruising speed of 326 mph and payload (usage capacity of 60 passengers for 360 miles or 30 executive passengers) capacity, the Napier Jet-Prop 540 provides a smoother ride at greatly reduced crew levels and improves economy of operation as active or business jetliner.

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structural modification to engine nacelles, new instrumentation, and electronic and radio systems modification in maximum down time.

Conversion of Convair 540s and 440s to Napier-powered Jet-Prop 540s is performed exclusively at A/RResearch Aviation Service, the most experienced company in the modification of Convair 540s, 340s and 440s into executive aircraft and luxury airliners.

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Customer confidence is our most highly regarded asset.



THE GARRETT CORPORATION A/RResearch Aviation Service Division

Identified Airport, Los Angeles, Calif. / Telephone (818) 611-1111

tion of those of the old B24, for example.

Moreover, after these three or several transport operations are loaded to a maximum speed of 127 kt, steep turns can be flown with considerable latitude by placing the nose on the horizon properly or by firing an instrument the latter being easier.

Stalls were performed during power-off, climb, with full flaps with full flaps and gear down. Although the stall characteristics are better and much identified, a vortex-shedding device which operates at 7 kt above stall speed is provided for transport work. Also and by so low it worked, the device was that all during the A/RResearch Work flights.

Still in the climb condition, first it with flaps and gear up, entered a wide climb, with full flaps control even at full stall. With power on, full stall was reached close to 16 kt, with power off at 62 kt. Raked full flaps movement of the ailerons and rudders are necessary to keep wings level with take full back in this condition.

With power on and take off, all the way back, maneuverable flight can be maintained a few knots above stall speed.

Stalls with full flaps are made at lower speeds but with practically unchanged characteristics.

Diffusing Characteristics

Stalls with full flaps and gear down, as would be the case in a full performance landing, produce different characteristics. The nose, for instance, goes back above the horizon, and full stall does not occur until 45-48 kt. Control can be maintained as in other conditions.

To approach the better use of the stall margin after, which is why, the Convair is considered an excellent aircraft. No experienced pilot need ever be caught near it, but if in performing full performance maneuvers he does first with full flaps, he is provided with sufficient margin.

Recently first a stall and even in store is allowed by simply pushing the yoke forward to lower the nose and gain speed, but if altitude cannot be sacrificed, takeoff power can be used instead.

Combining a propeller and staging an engine in flight involves no unusual procedures. However, what happens when this is done is unusual. The endoplane pilot gets into with firm grip on the wheel and feet steady on the rudder pedals. However, it is soon apparent that little use pressure is needed to make up for the yaw, and little extra head control is required on the yoke.

After training for single engine flight, turns can be made into the dual engine with ease, a procedure not

to be encountered for most multi-engine aircraft.

Landing approach is not standard—although a beam of steep glide angles. The nose is pointed down sharply to maintain three speed and to prevent premature stall when the flaps are retracted. Touchdown is made only slightly nose high, with the ailerons held in the down position. The wheels are allowed to touch down immediately, and brakes are applied. Landing rolls are the same as for multi-engine aircraft with considerable margin.

For maneuvers under 100 kt, and it is in this area where the AC1 will operate a great portion of the time, no steep approach is required, 50 ft between 50 and 100 kt would seem advantages. Present configuration is suitable for any 50 and 100 kt.

The Convair approach allows control for operations into and out of short, rough fields. It carries an appreciable load and offers no flight characteristics which would compromise the pilot's operation under field conditions.

CG Calculator

To simplify Convair operations in the field, the Hamilton has provided a new cylinder of calculator for 601 for fast, easy weight and balance computation. Center of gravity, based for the aircraft, extends from a 20% forward CG limit at 21,600 lb, unbalanced air to a 10% forward limit at maximum gross weight of 26,000 lb. The aft CG limit is 81% for all weights. Loading stations are given 3 in. and 10 in. and 10 in. at the center of gravity.

There are separate air systems for each engine. Provision is made for oil delivery in cold weather operations.

Rare Convair aircraft is a direct-drive engine with 181 cylinders. A dual engine 1251, 400-cylinder engine covers the whole range. All engine parts and engine installers are readily accessible in the cockpit area. For single pilot operation, an optional or instrument window, a knowledge of observer or crew chief would be a valuable asset for management of all the emergency reduction.

Hydraulic power at 3,000 psi is applied for flap or downing system to operate the landing gear, flap interlocks and the interlocked reverse mechanism. If emergency is normal service there is a hand pump on the deck to the right of the pilot.

This can be used for normal operation if desired. When used at the power and quick take, the hand pump draws fluid from the emergency reserve level of the hydraulic reservoir. Reserve is made possible by refilling at the left rear of the cockpit.

If normal and emergency hydraulic

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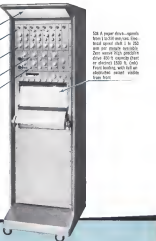
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systems fail, the main leading gear can be dropped by gravity, and the nose gear can be blown down in a single shot compressed air charge. Emergency landing can be accomplished by a two combustion engines supply heat to the undercarriage and the cabin area. Windshield design is done by electric heating.

The detection and extinguishing systems provide fire control in three zones—one forward of the engines, forward, another in the accessories section between the engines, and under the fuselage, and the third in the wheel well compartments. Extinguishing agent is from 1960. There are separate detection and extinguishing systems for each location.

Each pilot position is equipped with a steel tube fashioned cockpit shell, seat, and one for passenger seat is located aft of the passenger door on the right side.

Emergency escape provisions are made for the flight and passenger compartment. In the passenger area, escape can be made from the two passenger doors, the pressurized cargo door and through the pressurized central hatch on the left side. Crew can escape through a top hatch and a lower hatch which is intended primarily for use with parachutes.

Each main landing gear consists of two 11 x 11 wheels with disk brakes and tires inflated to 35 lbs psi. An also pressure shock strut, a drag strut and a struts which connect the gear into the engine assembly. The wheel axle connects an extension to allow the gear to fit into the wheel well. The main gear has been tested successfully at sink rates of 14 fpm, and it is designed to take 50 fpm.

The auxiliary nose wheel has two 7.9 x 10 wheels mounted side-by-side attached to an oleo-pneumatic shock strut. When the gear is down, the struts are in the wheel well. The nose wheel is shock absorber through oil legs. In either side, the struts can turn in place, pivoting on the outside wheel of the main gear.

De Havilland to Build Transall Propellers

LONDON—De Havilland Aircraft Co. will supply propeller equipment for the three prototype Transall C-160 transport under a contract worth about \$1.5 million.

De Havilland says the 18-ft propellers will be substantially larger than any yet made in Great Britain. The Transall, powered by two Rolls-Royce Type 693 turbo-prop engines, is scheduled to make its first flight in 1967. It is being built for the French and German air forces by a consortium of companies in France and Germany, including Nord Aviation, Wessling, and Heinkel.

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Answer to last week's problem: The first student will have said "No" whether or not he is studying liberal arts. Hence the second must be before the third, and hence is not in liberal arts. If the third is not in liberal arts, then the first is, and vice versa. There is only one liberal arts student. If the third is in liberal arts, then he is applying and the first student is not in liberal arts. But the word "really" implies he said he was a liberal arts student, which is impossible. Hence the third cannot be in liberal arts, and thus the first is.

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Military Studies Ground Effect Vehicle

By David A. Anderson

Detail.—Construction of first scale, physical ground effect machine (GEM) for a military mission could start this year with funding available for Fiscal 1963 appropriations.

GEM progress during the past two years has been rapid enough to justify design studies and consequent procurement leading to an amphibious support vehicle, and Lt. Col. J. L. Warren, USMC, at the 1961 School of Automotive Engineers International Convention here.

Vehicle would be designed to carry a 10,000-lb payload, could weigh approximately 60,000 lb., and have a cruise speed of at least 60 kt. With a total of 4,800 installed horsepower, cruise altitude would be about two feet and bow or height above three feet. Overall vehicle width would be about 40 ft., length about 65 ft., and effective diameter of the vehicle, 55 ft.

Currently supported by 34 military researches ranging from fundamental flow studies through procurement of complete test vehicles, the field of ground effect machines has developed rapidly during the past three years. There are now at least 18 known facilities carrying either in large model form or in full scale operational or experimental configurations. Research spending has been relatively small—about \$2.5 million per year—but the results produced by that relatively small investment have surprised everyone by their magnitude.

Amphibious Mission

Most of these results included one inherent point about the GEM. It works best where it has no competitors. If it is designed to race against, then it can be effective, and M. M. Corley of Wright Associates Inc., Dayton, Ohio, notes, that someone looks like an amphibious one, with the GEM serving as an off shore supply vehicle.

Which critical GEM effect, it Wright and other development organizations are now at the USGS (logistics) over the short mission which calls for cargo pickup over a beach or lighted defended beach. The supply route requires that the vehicle disgorge cargo at the beach, then, stationary perhaps 30 to 100 ft. off shore. The mission may be with personnel, weapons, but it is not loading. There is a wall with wave height of three to five feet from crest to trough and sea strength of 150 to 180 ft. enough to trough.

In such a situation, a 10,000-lb. payload GEM would have a delivery rate to the beach about equal to that of a 3-



DETAIL.—An article on latest drawing of the Curtiss-Wright Model 100 VTOL, shows design change from low winging machine to one before postscript.



MODEL 100 steep angle transport VTOL design due to change to stable tailless engines. Propellers will be introduced in order to provide engine-out control.

Lorrie 5.6 ft. diameter. Corley pointed out plus in expected advantage of non-erosion and delivery.

But some problems remain and not the least is the concern that U. S. GEMs are lagging behind the present development of the British by about one year. Peter G. Hilding of Boer Allen Applied Research Inc., pointed out that Savannah-like scale is much as the entire field with its construction of Colson's like coastal and is now well along with contractors of a second vehicle aimed at a commercial market. The SRN 2 (Haworth) is de-

signed to carry 60 passengers or about six tons at freight at a 75-kt. cruise speed.

Picking out that British development including S.R. Vickers-Armstrong, Ltd. and Smeeth-Bell, vice sponsored with a commercial contract by British industry. There is no military money in the contract, the art of the designers has been to get useful money making commercial machines to sell primarily in the British Commonwealth.

In contrast, it is difficult to justify existence of a GEM as a commercial



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born in the United States, primarily because transportation here is supplied by roads, railways and rivers. But in specialized applications, where roadless terrain presents a major barrier to conventional vehicles, the GEM can come into its own.

Carlier said the low "footprint" price tag of a GEM—in the order of one half pound per square inch—makes it able to sneak through a windshield without setting off pressure sensors, which generally require about one pound per square inch for detection. Wright is working on development of a sound-detecting GEM in two forms: one where the sensor itself is a GEM, located on a parent craft, and one where the whole head and associated equipment is a remote-controlled GEM.

Part of New York Authority has shown interest in another Wright idea which features the GEM as a noise vehicle for airports surrounded by urban sprawls or noise zones. La Guardia and New York International Airports are such examples, with corridors of shallow water filled with a marine growth which acoustically dampens operation of conventional boats. GEMs could sneak an aircraft downed off the end of a runway in an extremely short time and could perform a sonic mission that no other vehicle could.

But many problems remain to be solved in stability and control, in determining structural stresses in ocean refueling—Carlier Wright's first vehicle had a cockpit noise level of 120 db, enough to deafen personnel a lifetime—and in the low friction of contact which makes driving one of these vehicles like handling a car with held tires on wet ice.

There is also a large segment of engineers who feel that these GEMs must be always provided by tank drivers, not be shifted remotely, and the design of ground support for this concept is a difficult one.

The GEM is not a manned vehicle, but it does have a pilot. Right now that pilot is a ground crew member, and only the pace of development on the sea line may well provide enough information on how to determine whether the GEM will be able to emerge consistently with cutting tops of ground and air targets.

First detail design characteristics of the Carlier-Wright Model 700 and 100 VTOL transports were presented by H. V. Bost and J. M. Morgan of C. W. F. Products Division another technical session (AW June 20, p. 277).

The Model 200, a single-engine, high-speed design powered by a pair of Lycoming T55 or General Electric T54 turbo-shaft engines, has four 141 propellers mounted at the tips to tandem stub wings.

Each shaft and propeller rotates through about 90 deg. for conversion from VTOL operation to the cruise phase. In the VTOL mode, differential propeller thrust is used for directional control about the three axes. During transition a combination of differential thrust and aerodynamic surface controls is used, and for cruise flight all control is aerodynamic.

At its natural gross weight of 12,300 lb., the airplane can operate at a mid-level standard day with one engine out and one maximum level flight with one engine out at sea level in its light envelope. Engines are water-shuttled to

that either engine can drive all four propellers.

Over all length of the six-place Model 300 is 45 ft., height is 30 ft. and span across the nose tips is 34 ft.

Model 100 is about 55% complete in detail design, and about 50% complete in construction.

Although the Model 700 is geared to a proposed military application, but not a specific requirement, the Model 100 is aimed at the short-haul transport market. Using the same configuration with four turbo-propellers, C-W engineers have designed a four-engine, 4,600-lb. aircraft intended to carry 16



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Flight Propulsion NEWS

A report on recent progress and research and products from Flight Propulsion Division of the General Electric Company



General Electric's Caravelle, equipped with CJ-650-33C turbofan engines, completed its maiden flight Dec. 29. Production models are expected to be available in 1964.

G-E Caravelle Logs First Aft-fan Flight

EDWARDS AFB, Calif.—Fifty-powered short/medium range jet engines became a reality here Dec. 29 as General Electric's CJ-650-33C powered Caravelle completed its first flight.

The modified Caravelle III maintained an altitude of around 20,000 feet on its maiden flight of 1 hour and 25 minutes. Test pilot Dick Berlin reported that "the additional 40% take-off thrust of these fan engines was very noticeable. It shortened our take-off roll substantially and improved our acceleration and climb gradient. We also had the feeling that we had plenty of reserve power at cruising speed."

Berlin added that he "pushed the aircraft up to 11", with a noticeable effect on fuel speed.

General Electric took delivery of the aircraft from Sud Aviation last summer to demonstrate the performance of an aft-turbine powered short/medium range jet engine. Since October, the Caravelle's original turbofans and auxiliaries have been replaced with CJ-650-33C turbofan engines and electronic dual-channel controls, fabricated by Douglas Aircraft.

Altho powered Caravelles are expected to be available for airline service in 1965, the production version of the CJ-650-33C powered aircraft will be added to the Caravelle VII Douglas will test and service the Caravelle VII in the U.S. and in most other parts of the world.

For more details on the Caravelle VII, check GED-4216. See coupon.

T64/de Havilland Caribou Flight Tests Set for May

LYNN, Mass.—A nine-month flight test program with General Electric T64 turboprop engines has been announced for the de Havilland DHC-4 Caribou STOL transport. The tests, slated to begin in May, will continue throughout 1964.

During the program more than 240 hours will be accumulated on two test engines: 20 hours of ground check-out and 100 hours of preliminary flight time are to be accomplished in first-phase testing. 300 hours of in-flight testing on each engine are scheduled to follow the initial test phase.

G-E's Small Aircraft Engine Department is responsible for installation and test engineering throughout the test period. Prior to flight test, inlet and prop tests are to be conducted at Lynn. The engine will log 7,600 hours of in-door testing before its maiden flight.

The T64 is available in four configurations—two turboprops, a turboshaft,



Two T64s will power the Caribou STOL flight program in a Navy-powered Gulf aircraft test program.

and a direct drive—for fixed-wing and VTOL, and STOL aircraft.

The T64 is one of the first jet turbines to match the low fuel consumption rates of reciprocating engines. At military power the turboprop version develops 3,200 horsepower and has a specific fuel consumption (SFC) rating of 0.495.

For additional details on the T64, check GED-4024. See coupon.

J85-powered GAM-72A Missile Completes Category I Tests

LYNN, Mass.—The GAM-72A "Green Quest," a dummy missile powered by General Electric's J85-7 turbofan engine, has completed Synthetic Air Command Category I testing.

All flight tests with the G-E engine were successful. The 600-shp diverterless missile, designed and produced by McDonnell Aircraft Company, has been undergoing developmental and flight tests since 1959.

"Green Quest" J85-7 turbofan powerplant develops 2,450 pounds thrust. Dropped in excess by a D-57G mother ship, the missile is designed to cruise at an altitude of 30,000 feet, maintaining the D-52 on empty radar screen.

For more information on J85 turbofan engines, check GED-4945. See coupon.



The GAM-72A "Green Quest" dummy missile has completed SAC Category I testing. At right is General Electric's J85-7 turbofan engine, which powers the 600-shp missile.

General Electric Offers Aft-fan Engine for Cargo Transport Aircraft

EVENDALE, Ill.—A new aft-fan engine, the 23,500-pound-thrust-class MF129C-3, has been offered by General Electric to meet modern air cargo transport requirements.

Developed from G-E's proven CJ-65-33 aft-fan powered engine, the MF129C-3 complies an advanced gas generator and a new "high power corrected" fan.

The MF129C-3 has design incorporate a two-stage turbine/compressor fan, aerodynamically coupled to the gas-generator compressor. The new fan provides a significant advance in turbine development. It is expected to improve performance over earlier turbofans as very improved exhaust turbine performance. Fan bypass ratio of 10 is optimum for a long-range, subsonic aircraft.

North American A3J Claims World Altitude Lift Record



Designed for lift 17-mile ascent was Commander Leroy A. North, pilot, and Lt. Leroy R. Rasmussen, copilot, of the record-breaking Vigilante. Commander North received the Distinguished Flying Cross. Lt. Rasmussen the Air Medal.

EDWARDS AFB, Calif.—The Navy's North American Aviation A3J Vigilante, powered by two General Electric J79 engines, on Dec. 13 filed a claim on the world altitude record for a jet-powered aircraft carrying a 1,000-kilogram (2,204.6 pounds) payload.

The claim, for an altitude of 61,548 feet, is now pending before the Federation Aeronautique Internationale (FAI). The Mach 2 Vigilante soared 43,024 feet over the previous record of 37,000 feet set in 1959 by a Russian two jet MV-1000.

The A3J, like all U.S. fighters in this altitude test, has two J79 powerplants, providing more than 22,500 pounds of thrust. The engines weigh less than 3,600 pounds each, to provide the lightest thrust-to-weight ratio in their class.

To meet FAI requirements in this event, aircraft must carry 1,000 kilograms as a cargo item, maintaining at least 141 cubic feet. On the record flight the A3J's payload was carried in the plane's tandem-lift inner bomb bay.

The exhaust exhaust, characteristic of aft-fan design, permits use of a quick-release, classified thrust reverser to enhance short-runway performance. The reverser may also be used to create thrust in flight.

Present schedule call for production engines to be installed with flight test engines available earlier.

For additional information on the MF129C, check GED-4216. See coupon.

The J79-powered Vigilante, faster attack aircraft in Navy history, is now undergoing flight tests prior to fleet assignment. Built for carrier operation, the all-weather A3J can deliver both nuclear and conventional weapons at twice the speed of most.

FOR MORE DETAILED INFORMATION on these and other developments in General Electric products, contact your nearest G-E Night Propulsion Division representative or submit below the free brochure you would like to receive.

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NEA, TWA Begin Convair 880 Service

EVENDALE, Ill.—The G-E CJ-465-powered Convair 880 recently entered service with two major contract airlines as Northeast Airlines and Trans World Airlines introduced the world's fastest jetliner to their routes.

Northeast Airlines' first 880 set a new record "route to meet" U.S. speed record during delivery Nov. 30, 1960. It flew from San Diego to Boston in 4 hours, 17 minutes. Earlier, a Delta 880 had set a speed record of 3 hours, 31 minutes from San Diego to Miami. TWA's begun passenger service with the 880 Jan. 32, on routes between New York, Chicago, Las Vegas, Los Angeles, and Phoenix. Delivery of the balance of 24 airplanes will place the 880 on TWA routes throughout the U.S. NEA incorporated 880 service on its Boston-Philadelphia-Miami Jan. 15. Powered by two CJ-465-3 engines, the 880 develops more than 61,000 pounds thrust. Engines are equipped with a classified thrust reverser and

exhaust sound suppressor. Four G-E hydraulic constant speed drive operate in parallel to power the aircraft's 300-hp electrical system.

For more Convair 880/CJ-465 information, check GED-4182. For constant speed drive data, check GED-4009. See coupon.



CJ-465-3 powered Convair 880 averaged 628 mph on 2,723-mile delivery flight in Northeast Airlines.

ENGINEERING REPORT ON BENDIX COMPONENTS



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passengers at a cruise speed of 100 kt at altitudes of 18,000 ft. Costs estimated by the Air Transport Assn. ascribed are as low as 24¢ per seat per available seat-mile, or for a 400-mi stage length, according to stage length for 166-one stage flights, based on 2,000-hr utilization per year.

Paraplanes

Paraplanes for the proposed Model 160 are from General Electric T64 turboshaft engines again attributed for open-air operations. Control system is the same as that specified for the Model 200.

Overall length is 72 ft, width is 64 ft, and height is 34 ft.

Now level is claimed to be low, due to the low top speed and loading of the paraplanes. Stage length is the same level as that specified for the Model 200. The new level is about 30 ft, less than normal for a car street. At 5,000 ft the new level is about the same as that of a residential area.

New details of Virel developments in compensated as advanced helicopters were presented by L. I. Douglas, of Boeing Airplane Co.'s Virel Division.

Douglas and the Virel Model 107-VT now under development will have a cruise speed of 175 kt. General close-up accounts for much of this gain with retractable landing gear, rotor hub bearings and extended blade life. A new hub design to reduce the drag, and large chord blades improving the lifting effect system. The resulting increase in lifting rate will produce the speed increase.

Two General Electric T58 engines, each rated at 1,400 hp, will power the 107-VT. Its gross weight will be 10,110 lb.

Compounding the Clonack now under development for the Army, is an air vehicle to increase cruise speeds. By getting a pair of tandem rotor wings on the base Clonack design, the gross weight goes up to 53,000 lb. In this current Clonack version of 53,000 lb, the cruise speed is 240 kt. The gross weight is estimated 160 kt to 227 kt and direct operating costs are estimated to decrease from 5.5 cents per seat mile to 4.9 cents.

VTOL Transport

Douglas also presented competitive figures for a four-engined tilt-wing VTOL transport, designed to carry 60 passengers at a cruise speed of 125 kt. Powered by four T58 engines, the transport at 2,850 hp, each, the VTOL transport would weight approximately 45,000 lb.

Calculations for the aircraft show direct operating costs of 1.5 cents per seat mile, almost as low as the 5.1 figure of the Fairchild F-27 which Douglas used as a comparison. ♦♦

PRODUCTION BRIEFING

Sylvania Electric Products, Inc., Buffalo, N. Y., will continue production of the electronic defense system for the Covair B-58 bomber under \$9 million contract. The electronic defense system consists of a radar warning subsystem, a shaft detector system and a radio track breaker.

Visco Corp., Detroit, Mich., will enter the hydraulic components field. Initial market for the hydraulic components will be the field of nuclear energy, however, the company expects to produce components for mobile and space vehicle applications.

Chrysler Corp. will supply component modifications and related equipment for the Jupiter intermediate range ballistic missile under \$3.1 million Army contract. To date, the Army Ordnance, Munitions Command, has awarded Chrysler Jupiter contracts totaling \$296 million.

The Harco Corp., Birmingham, Ala., will maintain aircraft assigned to the Army Aviation School, Fort Rucker, under \$5-million contract. The contract was awarded to Harco by Headquarters, Third U. S. Army.

Northrop Corp.'s Radiologic Division, Van Nuys, Calif., will produce 770 RUT-1 target simulators for the Army under \$2.9 million contract. The announced, sub-propellant launch will be used in training Nike Ajax and Nike Hercules air defense missile crews.

Tool Research and Engineering Corp., Beverly Hills, Calif., will provide tooling for the YB-70 bomber under \$2.9 million contract with North American. The jig and fixture and special tooling for mechanics and technicians of the B-70 will be produced at the company's Compton, Calif., facility.

Wynco-Gordon Co., Worcester, Mass., will expand its hydraulic forging capabilities under a \$3-million firm pay-fixed-plus-incentive contract with the Air Force. The firm is to produce the hydraulic forging equipment for the company's Franklin Park, Ill., plant to North Grafton, Mass. This is intended to increase the Manufacturers' plant's capability in forging small hydraulic components.

Comac Aircraft Co.'s Industrial Products Division will establish a hydraulic equipment assembly plant in Glenview, Ill., scheduled to begin operations this spring. The facility will assemble Comac's agricultural and earthmoving hydraulic

equipment for sale in the United Kingdom.

Additional funding in the amount of \$4,043,537 under a U. S. Navy contract has been received by Lockheed Aircraft Corp.'s Culver City, Calif., plant for electronic development of F2V-7 and F2V-7 aircraft. The total contract is in the amount of \$35 million and includes 100 of the maintenance and repair equipment in Navy service. The new electronic equipment permits submarine detection at greater range than with previous gear.

Stek Airway has awarded a \$1.7-million contract to Pacific Aerospace Corp. for overhaul of Rolls-Royce Tyne engines on the Canadian CL-44 which the airline will take delivery on in September. First Tyne engines under the contract are expected to be in use at PAC before the end of 1961 with cycle time averaging 21 days.

Bowmar Instrument Corp., Fort Worth, Tex., has received a \$12,000 order from Ford Instrument Division of Sperry Rand Co. for special direction angle content to provide digital read-out on airborne navigational units.

General Electric's Missile and Space Vehicle Department has been awarded a \$200,000 contract for research and development in the field of high-temperature materials for space power. The NASA contract calls for work to use heat energy conducted from the sun so that electrical power can be produced at satellites while they pass through the earth's shadow. Work will include investigation of materials that can store heat and also materials that can contain the heat-producing materials.

Garratt Corp.'s Aircraft Manufacturing Division, Phoenix, Ariz., will produce dual propeller engine starters for the Republic F-105 under terms of a \$100,000 contract from the Air Force Materiel Command.

Gelco Industries, Inc., will supply tooling to digital control system to the Army for use in the Squigat scale prepared under terms of a \$45,000 Army contract. The tooling to digital control system will be used for measuring scale guidance and flight stability.

Aeronautical Division of Ford Motor Co. will develop structural and wing-rigid space structures for use at extreme altitudes under a \$140,000 contract from Wright Air Development Div. Contract results from two previous proposals developed by Aeronautical Division of Ford Motor Co. which provided guidelines to the Air Force for using rigid structures in space.

ENGINEERING REPORT ON BENDIX COMPONENTS

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Kennedy Group Criticizes Space Effort

A special task force headed by the new White House science adviser Dr. James B. Watson, has made a study of U.S. space and scientific efforts for President John F. Kennedy. Because it is expected to become a blueprint for the new administration's review of both programs (ENR Jan. 16, p. 35), *Answers Week* is giving the entire report and its recommendations.

Activities in space now coalesce in major categories:

- Satellite missions
- Scientific observations from satellites
- The exploration of the outer planets with instruments carried in deep space probes
- Military space systems (Defense Classification Report)
- Use in orbit and on space
- Nonmilitary applications of space technology

We rely on the first number of the list, satellite missions, for a large part of the retaliatory response to the Russian missile threat.

It is generally conceded by the American science and defense establishment that our present expenditures of money and technical effort in the national space program are grossly deficient to meet the overriding needs of our national security. The fact is, however, that the space of our continent and ourselves has moved away from the missile field to the orbit stage of the war, and that our satellite being before they are available to us to depend upon them, are slowly being adopted to the category of military equipment.

Before we proceed in that report, it seems and support the important activities in the orbit for the purposes we seek to achieve the hazard of failure to complete and deploy, as time that international defense needs.

In addition to the need to develop full-time research to provide for our military security, there are few personnel resources for doing a valid scientific space program. It is important to distinguish among them who are attempting to achieve our national space effort.

National Prestige Factor

First there is the factor of national prestige. Space exploration and exploration have captured the imagination of the people of the world. During the next five years, the prestige of the United States will in part be determined by the leadership we demonstrate in space activities. It is a factor for which we must consider that in space. Given space a decent, considerable, scientific, and sufficient effort and means, we can eventually explore our solar system. Given his extensive contacts about the science in which he lives and has his professional life to go, he will not let his eyes look before this will be done.

Second, we believe that since space development, as satellite to satellite, can contribute much to our national security.

—Both in terms of military systems and of nonmilitary responses and control systems.

Third, the development of space activities affords new opportunities for scientific observation and exploration—taking to our knowledge and understanding of the earth, the solar system, and the universe. In the last years since space exploration was initiated the United States has been the outstanding contributor in space science. We should make every effort to continue and to improve this position. Fourth, there is a number of important practical non-military applications of space technology—using their satellite communication and broadcasting, satellite navigation and geodesy, meteorological reconnaissance, and scientific mapping—which can make important contributions to our civilian efforts and to our economy.

International Cooperation

Finally, space activities participate in the fields of communication and in the exploration of our solar system, offer great possibilities for international cooperation with all the nations of the world. The very scientific and linguistic space projects would prosper if they could be carried out as an expression of cooperation in projects of all mankind instead of in the present atmosphere of national competition.

The old line and has made a heavy reliance of the national space program, trying to use the efforts to provide a survey of the program and to identify personnel, technical, or other activities which require the prompt attention of the Kennedy Administration. We have identified a number of major problems in each of these categories, and they will be discussed in this report. It is obvious that there has been inadequate time to consider all fronts of the program or to give full consideration of the possible answers to many of the questions raised.



DR. JAMES B. WATSON

Because of the overriding necessity to provide more efficient and effective leadership for this program, the group has devoted a major portion of its time to the review of the space program. We will, however, also report significant scientific and technical problems which should be thoroughly reviewed as soon as possible.

National Objectives

We have concluded that it is important to review thoroughly national objectives in the space effort—particularly in regard to man in space, space science and exploration, and the non-military applications of space in order to assure a proper division of effort among these activities. Space activities are so interrelated in nature and people work on in the field, it is suggested that the review program would evolve from the end state more before of dollars per year.

While we see one important factor in reviewing our space program and its development, we need first give adequate recognition to the dedication and talent which brought about this program in spite of the last few years. Our immediate accomplishments to date are impressive, but unfortunately, against the background of Soviet space achievements, our large losses they have not been impressive enough.

Our review of the United States' space program has identified a number of major national and management deficiencies as well as problems of staffing and direction which should receive prompt attention from the new administration. We have identified our problems within NASA, within the military establishment, and at the executive and other policy-making levels of government. These activities are discussed in the sections which follow.

The nation's behavior needs program is helping. The development of the scientific and of the national space system, the new construction and scientific personnel used all be considered if we are to have the most rapid development from now that the country has been led to report.

While additional funds will undoubtedly be required to accomplish the objectives that we believe are necessary, technically competent management for the program is the overriding concern.

Missile Effort Vital

Though the missile program is not as much regarded as part of the space program, it is important to recognize that the use of the achievement of an adequate data first is much more important for the nation's security than the work of the space objectives and that of the first part of the difficulty in the management and execution of the program stems from the dedication within the Defense Department and at the executive level and not new space projects. However, we have an illustration that to permit forward with space development.

There is an urgent need for more effective management and coordination of



Seventy S-60 Skycrane hoisted in heavy cargo container weighing 1,000 lb. from the hold of the U.S. Army transport Hickory Knoll during a demonstration by U.S. Army Transportation Corps at Ft. Stan. Vt. Skycrane was made with a much larger tank and 200 ft. of steel cable, as the Skycrane lowered directly over the forward hold. Similar demonstration also was made in the New York harbor.

S-60 Skycrane Lifts Container From Ship's Hold



About two minutes after lifting the container from the forward hold of the Hickory Knoll the two-ton package was lowered to the bed of a truck on the beach. Work party of seven left a handling team to study the container as it slides onto the truck bed. Hickory Knoll is at left background. Photographs for the Skycrane by Fred B. Whitely R. 2206.

Digital imaging gives you fast, precise selection of any one of 20,000 frequencies—less than 3 to 30 milliseconds—and locks on. Frequencies have a stability of one part in 10⁶ per month. Highly time-synchronized, the unit draws less than half the power of comparable AMR equipment, and where buses are used, a unique

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21



Discovering the principles of scientific filtration

CHARLES' LAW $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

"Gases under constant pressure expand at equal proportion from the same temperature for equal temperature increments"

Jacques Charles (1746-1823)

Through his interest in ballooning, French physicist Jacques Charles, in 1787, determined that the pressure coefficients of expansion of all gases are the same. Further study by Gay-Lussac in 1802 revealed that all gases have the same volume coefficient of expansion. Later Regault observed that the increase in volume per degree centigrade was 1/273 of the original volume.

Similarly, at Air-Maze, constant research and testing establishes new principles to improve filtration. For 35 years Air-Maze engineers have worked together producing new industrial filtration products based on the findings of Charles and others. The result is a complete line of specialized industrial filtration products for every situation involving the removal of gases and liquids.

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our planet out of the sea-earth relation. One of the important tasks of space science is to find out how space will be a full explanation of the new field needed by the early experiments. There is little doubt that such exploration will lead to further important discoveries.

Advances in Astronomy

Another scientific field where space science promises us only and more today, though it is that of astronomy. Until a few years ago, visible light from celestial objects, reaching our telescopes through the atmosphere blanket, had been the only source of astronomical information available to man. The only other portion of the spectrum capable of penetrating the atmosphere and the universe is that corresponding to short-wave radio signals.

In recent years, the development of radio telescopes has made it possible to detect these signals. Radio astronomy has, consequently, advanced our knowledge of the universe. By means of radio telescopes we can now "see" not only the stars, but also the great swarms of gas between the stars we can detect the high-energy electron stream caused by various celestial bodies located thousands of billions of light years away from the earth.

We are not able to expect a similar and even perhaps a more spectacular advance in the field of radio astronomy, as it is still about analysis making the path down the atmosphere and the universe. Thus, instruments will be capable of detecting the electromagnetic spectrum from long wave radio signals to gamma rays.

A third aspect line of space science in the years to come will be the exploration of the moon and the planets. Scientists are planning to fly instruments to the vicinity of these celestial objects, and eventually to land them upon their surface. From this data supplied by these instruments, they expect to obtain information of decisive importance concerning the origin and the evolution of the solar system. Moreover, there is the distinct possibility that planetary exploration may lead to the discovery of extraterrestrial forms of life. This research would be one of the greatest human achievements of all times.

Scientific Talent

One present hindrance to a space science is due to a lack of talent in the early participation of some of our ablest scientists in the space program—generally as part of the International Geophysical Year—and in the fact that these scientists are in a position to influence the program. An often neglected factor was not initial involvement in instrumentation which helped to offset our shortcomings in preparation.

We must now devote ourselves into training that it will be easy for the U. S. A. to maintain in the future a permanent position in space science. The USSR has a number of competent scientists. It will be easier for them to catch up with us in automatic development than for us to experiment to catch up with the Russians in the techniques of propulsion. Thus we must push forward in space science as efficiently and as intelligently as we can.

One wonderful progress in space science to be heavily used. However, to choose



Tracking Every "Bird" in a Flock

Keeping track of a sky full of "birds"—whether friendly or enemy—poses one of the most complex problems in modern radar electronics.

Control centers must know where each aircraft is at all times, wherever the weather. This means its direction, its distance, and its altitude in relation to all other "birds" in the sky. And they must know (therefore, for security) rates at modern speeds.

In cooperation with the Air Force, Westinghouse Electronics Division, a Belmont has developed a new 3-dimensional radar that can accomplish

this difficult task—the versatile AN/FPS-27.

One radar supplies both search and height data simultaneously. In an automatic system, it can supply real time digital data on an unlimited number of targets.

The AN/FPS-27 and other 3-D radars such as AN/TPS-27 and AN/SPG-59, plus high discrimination radar techniques such as Phased and Synthetic Aperture, are examples of how the Belmont division of Westinghouse are applying electronic science for Defense. You can be sure if it's

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Failures Plague Atlas Space Launchings

By George Alexander

Failure of the Atlas-Able V-8 launch probe, which exploded 46 sec after lift-off on last Dec. 15, appears to have been caused by a premature ignition and subsequent explosion in the second stage Able.

Two factors are:
 • Acceleration aboard the Atlas booster showed a marked deceleration shortly after accelerometers on the upper stages registered a sharp acceleration. This would indicate that the upper stages experienced a strong upward propulsive thrust which, at the same time, applied a negative force on the Atlas. Further, all telemetry on the upper stages was not instantaneous—followed after a very short time interval by a breakdown of all booster telemetry. The direction of the failure was downward from the upper stages.

• Observers at Cape Canaveral reported seeing a doughnut-shaped flashoff at about the time of the explosion. Engineers say that the only logical explanation for such a phenomenon would be the aerodynamics of the Atlas passing through a flashoff about 2, 10, 15, or 20 stages.

Able Performance

Exact cause of premature—by about 34 sec—ignition of the Aerojet Able second stage has yet to be determined. Able has a good record abroad. Thor and Delta boosters (14 successful shots) and several Agenas were of 18 flights including failures where the vehicle did not have the equipment to operate, but the Able modified for the Atlas series has not performed as well. On Atlas-Able V, launched last Sept. 25, the Canaveral Atlas performed normally and separated from the upper

stage. The Able engine, however, ignited roughly 30 sec after lift-off and failed to achieve full power. The payload consequently did not go into orbit.

After the first Atlas-Able IV vehicle exploded during a static test at the Cape, a backup vehicle was launched on Nov. 26. At about 40 sec after lift-off, the glow filter protective firing started the payload and third stage suddenly left off. Still within the strapdown, the upper stages were subjected to extreme aerodynamic buffeting and an induced motion, the payload and third stage were torn off, falling into the sea. Investigation later revealed that failure to compensate for pressure differences—at sea level, where the firing was attempted, and at altitude, where it should have properly occurred—was the probable cause of malfunction. Tracking data and telemetry showed that the Atlas burned to within a second of the programmed time and there were signs that the Aerojet Able engine fired all through separation could not be determined.

After Atlas IV, all failures were drilled with new holes to preclude a pressure buildup within the firing and the acceleration was not repeated. Reason failures have plagued these space programs which have employed Atlas as sub-stage booster. Only one shot can be considered to have been completely successful, from an over-all mission viewpoint, and that is Project Scout—the Atlas which carried President Eisenhower's 1958 Christmas message to the world. The Atlas itself has performed well in all but one instance.

In the launch of the "Big Joe" test-payload Mercury capsule on Sept. 9, 1959, the two booster engines of the Atlas failed to separate, thus shortening the flight range by several hundred miles and placing the capsule along a nearly straight-atmosphere angle. When the capsule withstood much higher g forces and temperatures than had been anticipated, National Aeronautics and Space Administration engineers cited the flight but as successful and cancelled plans for a second similar shot.

Atlas Shere

The first Atlas shot, last Feb. 26, resulted in an explosion of both the Atlas and the Agena satellite successfully following ignition. USAF has never revealed the cause of malfunction, but it is known that Lockheed made some changes in the upper section and upper driver for subsequent Atlas-Agena flights. Atlas II, launched May 24, achieved a near-perfect orbit.



First Zeus Guided Flight

First guided flight of Atlas-Able IV was made at White Sands Missile Range, N. M. last, test, during development of the guided war package with Western Electric Co., space contractor. The missile was fired by personnel of Bell Telephone and Douglas

but telemetry showed the satellite failed after the 10th orbit and the Atlas period did not receive the wrong USAF had planned for it.

Scout I, launched Oct. 11 from Ft. Argus, Calif., but all gas pressure system required for attitude stabilization at time of lift-off when the satellite was of a series of the Agena's star. Although located in the correct vehicle by Atlas and although its own engine started, the Agena vehicle was not stabilized and did not go into orbit.

The first Mercury Atlas launch carrying a precision line streamer of the McDonnell capsule, exploded 45 sec after lift-off on July 29. Although exact cause of malfunction is unknown NASA is critically studying the vibration strength of the McDonnell ship by surface (AVR Jan 16 p. 37) and intends to lead up the case. American West also learned that telemetry from MA-1 indicated that the shingles along the conical attachment of the capsule were vibrating at extremely high frequencies, although there is no evidence that any single one loose.



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ATLAS-ABLE V-8 is shown as it lifted off from Cape Canaveral last Dec. 15. Intended to orbit a satellite around the moon, the vehicle blew up 46 sec after lift-off. It was the third and final vehicle in NASA's Atlas-Able series.



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AVIONICS

AGREE Program Reveals Failure Causes

By Philip J. Klein

Philadelphia—Air Force and industry cooperation indicates that the tough new AGREE reliability procedures are a very effective mechanism for sorting out those causes of unreliability, both in the equipment and within industry itself.

As a result, Air Force contractors may soon find profit margins on contracts type contracts pegged to the mean time between failures (MTBF) of the items upon which they deliver, as measured by AGREE test procedures.

Results of Air Force and industry experience under the new procedures were reported here at the Seventh National Symposium on Reliability and Quality Control by G. W. Lindsay, of the Air Materiel Command in Dayton and by H. L. Hoffmann, president of Hoffmann Electronics Corp. Hoffmann was the first company to undertake a major production contract, the AN/ARN-210 Ticon sets, under the new AGREE procedures (AVF June 13, p. 87).

James Bridges is chief of electronics in the Office of the Director of Defense Research and Engineering, and the results of the use of AGREE procedures "are extremely gratifying," as a statement volunteered from the floor. The AGREE test procedures were developed by the Advisory Group on Reliability of Electronic Equipment (AGREE), under the sponsorship of Bridges' office.

Plant Trials

The ARN-210 Ticon sets built by Hoffmann are just beginning to see field use. There have been no few failures as far as it is not possible to statistically predict the MTBF size, one expects to exhibit in field use. Hoffmann, personal observations are that the 150 hr MTBF demonstrated under AGREE factory tests will be at least equaled in the field, and the figure is likely to reach 750 hr. If it would be several times the MTBF figure calculated by previous ARN-210 sets.

The impact of the AGREE procedures finally has been felt by companies that have passed on its use. "How in some of the industry, comments reported by Lindsay.

Radio Corporation of America, which built the AN/ARN-210 Ticon sets, says that AGREE procedures "While we support the inclusion of the AGREE reliability requirements

damage negotiations, we now are glad that it was done as we have learned things about our operations that we did not even suspect."

• **Unidentified unsatisfactory of doppler side** "The (AGREE test) program has contributed more toward product improvement than any reliability program contributed to date. Former (contractually required tests were superficial field tests lacked controls which are necessary to isolate faults)."

Hoffmann was even more candid in discussing the impact of the AGREE procedures on his company, which he said had tested "a complete trailer (most of our internal products)". His comments are particularly significant because Hoffmann was one of three com-

panies which produced the predecessor ARN-210 Ticon sets.

Moving into ARN-210C production, however, Hoffmann had in electronic sources of 15 sources that had been granted in performance of ARN-210C requirements, improve reliability of the set and raise the operational environment from 30,000 ft to 70,000 ft at full power without penetration in addition to meeting 150 hr MTBF under AGREE tests. Hoffmann contracted to produce the improved ARN-210C at a lower price than the predecessor equipment and to begin deliveries nine months after the start.

To meet the AGREE test requirements meant that there could be no more than one weakness per antenna



B-52 Electronic Countermeasures Antenna Tested

Washington "universal antenna" used on B-52 is shown undergoing test at Boeing's antenna test facility at Wichita. Antenna is particularly useful for electronic countermeasures, and direct communications. Boeing develops test software and transmits in those operating at frequencies up to 75 kHz.

SILICONE SEALS from HADBAR, INC.



Photo courtesy of Douglas Aircraft Company

Fuel Resistant O-rings for Jets

Since 100 flexible fuel-line couplings on the DC-8 jetliner are sealed by special HADBAR O-rings. For safety, the O-rings, like the two exposed above, must retain elastic properties and dimensional stability despite prolonged contact with jet fuel at temperatures from -30°F to +140°F.

HADBAR 21000-80, an elastomer based on Dow Corning's Silastic® LS fluorosilicone, was compounded and precision-molded by HADBAR technologists to meet exacting Douglas specifications. For HADBAR, Inc., for aerospace, automotive, hydraulic and other advanced elastomers.

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SILICONE NEWS from Dow Corning



Photo courtesy of Douglas Aircraft Company

Fuel Resistant O-rings for Jets

The DC-8 jetliner uses more than 500 flexible couplings as fuel lines. Leakage at any coupling is prevented by two rubber O-rings that must retain their rubbery properties and continue to seal as an O-ring should, despite constant contact with jet fuel.

Douglas engineers, after extensive tests, chose a special rubber compound based on Silastic® LS, the Dow Corning fluorosilicone rubber. Silastic LS meets fuels, oils, used hydraulic fluids and solvents... doesn't swell, or become tender.

slippage, excessive costs and/or the necessity of gasketing systems.

Leadley conceded that the addition of AGRÉE programs may add to initial procurement cost and delivery schedule lag. However, that is "far outweighed by saving in maintenance cost, by easier lighter support, by increased effectiveness and by reduced numbers of rescue vehicles required," he said.

One of Leadley's observations is of special interest to Air Force contractors: particularly those who have been reluctant to set up reliability groups or to fight their adequate authority. "Provisions must be made to avoid conflicts concerning reliability requirements with to contractors having demonstrable competence."

In a symposium presented table discuss on an permanent permanent program and their effort on equipment at HADBAR, Mr. Gen. W. A. Davis, one member of AMCI's Aeronautical Systems Center in Dayton, stated neither in single of how a company's reliability capability, can be... a recent... reliability... contract... for AGRÉE reliability tests, the two companies that submitted the least had been ones which have well-established reliability groups while the two highest reliability programs, according to Gen. Davis. He attributed this to the fact that the experienced companies had as great considerable more problem than their lack as a budget against the reliability.

Operational Study

The Air Force recently has contracted for a one year operational study by Vetus Corp. for a field study of three F-101 systems each at a different base, which are equipped with the new ARN-21C Tacan sets. The three bases are Malmstrom and Glasgow AFB, Montana and Chidwell AFB, S. C.

One of the major objectives of this program is to evaluate the reliability of the new equipment in field use and to determine what corrective actions be taken for the AGRÉE Tacan, for NITE figures and those observed in actual use.

If the study shows significant improvement in the reliability of the ARN-21C over its predecessor, then, it is expected that the AGRÉE test procedures will become a standard portion of used USAF procedures.

Navy's Bureau of Weapons, which has not yet issued any contracts with the AGRÉE program, plans to submit as well as ARN-21C systems. These tests, being developed by TET Pacific Laboratories, to the AGRÉE tests and to compare the results with other reliability test procedures to determine their appropriateness for Navy missions applications.

Microelectronics Studies Gain Support

By Barry Miller

Los Angeles—The armed services plan to fund a number of development programs in microelectronics early this spring in a new round of support for promising technologies which, they hope, will yield small, reliable and low-power components and circuit functions for future defense systems.

All of the proposed programs are well equipped with the assistance of dollar efforts funded by the Air Force and Army at Womackhouse and Radio Corp. of America, respectively. The Navy, which has remained aloof from any long commitment to microelectronics as recent years, will now support microelectronics with at least three separate—not too sharply defined—efforts of two from each service in scope.

These will supplement the limited support which has been received in the past through its participation in the Army Navy Information Program (ANIP).

Initiatives, proposals are being evaluated and contracts are expected to be awarded by the end of the year. • **Combination thin film dielectric and optical nonconductor program** sponsored by the Electronic Technology Laboratories of the Air Force's Wright Air Development Division. Proposals for this program, which is to be a three-year effort, will be in Dayton, Ohio, at the end of the year and an award is expected by mid-March. Funding report will be at the rate of \$40,000 to \$50,000 a year.

• **Construction and protection** which requires effort which would be the development of a unified and complete method of connecting and interconnecting functional circuit blocks, long required as the chief obstacle to the use of high component density potential of various microelectronic approaches. This will be a two-year effort to be funded at about \$100,000 a year by the Electronic Technology Laboratories.

• **Circuit optimization** for microelectronic applications program, scheduled as a three-year study and development effort to determine capabilities of thin film integrated circuits, etc., for Army's continuous wave communications and digital data processing gear. Slightly under \$100,000 is available for the first year of this program. Proposals for this contract are being solicited by the Army Signal Research and Development Laboratory, Ft. Monmouth, N. J., and an award is expected in early March. This program is considered to be and reflect a different concept than the microelectronics program and its associated contracts.

• **Deposition of thin films of complex dielectric compounds**. Proposals for this Signal Corps contract are due for receipt at Ft. Monmouth Jan. 25. Dollar value of this award is estimated to be below \$100,000.

• **Circuit area integration** package capable of being employed in the microelectronic program. This two-year contract will involve developing a silicon technology measure, the TNOV, into a complete package 40 mils in height and 25 mils in diameter. The device is required to have 100C storage capability. Contract for a similar type of "package" package, this one in glass, recently was awarded to Shuman Electric. The contract package award is expected on 31 March at Ft. Monmouth in New Jersey.

• **Seamless conductive** surface protection techniques study to be funded by Air Force's Cambridge Research Laboratories.

• **Development of batch deposition techniques**, deposition patterning devices, continuous deposition techniques and extended materials research under program. It will use part of the \$11 million awarded for the program as the final 1967. Researcher budget for applying these techniques in the design and construction of small, cheaper components low-cost satellites (AW Jan. 2, p. 41).

For some time a special Navy microelectronics group has been working closely of industry and government-sponsored microelectronics efforts. Initiatives are that the Navy is about to push several possible efforts. Besides the active family and the Electronic Technology Laboratories, another laboratory to evaluate microelectronics in being set up by Bureau of Weapons at

throughout the early months of this year. The Signal Corps is believed to be weighing the merit of a contract for a contract covering single circuit microelectronic deposition on dielectric substrates.

In addition, under Navy Bureau of Ships auspices, the Naval Electronics Laboratory at San Diego began setting up a laboratory several weeks ago to conduct small-scale research and development in microelectronics. This new laboratory will explore the nature and applicability of different microelectronic techniques for specific small systems. As part of this work, NEL's Microelectronic Laboratory will subcontract to indicate the risk of building various components, each made by different microelectronic techniques to that can evaluate them on a comparative basis.

Navy's Space Initiatives

Navy is known to have a strong interest in active microelectronic techniques for its growing information program. It will use part of the \$11 million awarded for the program as the final 1967. Researcher budget for applying these techniques in the design and construction of small, cheaper components low-cost satellites (AW Jan. 2, p. 41).

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IFF Airborne Transponder for German F-104Gs

IFF airborne transponder, AN/APX-46 (N), for radio identification, has been ordered by West Germany for use on its F-104Gs. The transponder transmits and receives by HADBAR Corp. is being used by U. S. and Canada.

SONIC VIBRATION PROBLEMS ON DC-8 SOLVED BY BLIND BOLTS



Along photo shows possible elastomeric frame joint (2000 psi max., 170° F max.) including hot of solid fastener. Blind Bolts in such frames and those under elastomeric frame joints can safely used to flight conditions. The repair on failed aircraft blind fasteners can also be used.



Blind Bolts were finally selected by Douglas DC-8 engineers for use in the Sound Suppressor. Extensive tests of various blind fasteners determined that Blind Bolts in temperature areas could best resist overall sound pressure levels reaching 150 decibels.

In this unusual application, the remarkable ability to the Blind Bolt to resist sonic vibrations stems from several of its inherent design features—the twin locking technique, combining the oval lock of the Expander to grip the thread of the Case Bolt and the wedge lock between the Expander and Sleeve and—the hole filling ability, resulting from the expansion of the Sleeve shank during the installation pull-up of the Expander into the Sleeve end—and lastly, the excellent fatigue resistance, gained from the high tensile preform imposed by the Core Bolt and from the cushioning effect of composite fastener materials.

Because the coefficient of expansion must remain the same to prevent loss of fastener grip, the compatibility of structural materials at high temperatures is essential. Inside the stainless steel Expander where exhaust gases reach 900°F., A-286 stainless steel Blind Bolts are used. On the outside where structural temperatures reach 300°F., Type 434 stainless steel Blind Bolts are used.

From the shop viewpoint, Blind Bolts are installed rapidly and quietly. Hole preparation is simple, no reaming is required. Only Blind Bolts offer a choice of gas driving tools designed for repair or modification in difficult or tightly congested structural areas. If sonic vibration is your fastener problem, consider Blind Bolts. Write for brochure.

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John Hagman Applied Physics Laboratory

Function of the advanced technology program at the various facility, according to a Navy representative, is to provide the various approaches to microelectronics, not to initiate a new approach. For this, specialized organizations will be assembled to produce microelectronics in various facilities. Navy wants it but not found in any specific approach although it considers that this is a leading idea. Several industry sources, however, indicate that what the Navy wants, as reflected in the program request, is a striking resemblance to the then first approach of one large company as set forth in its reports for another government contract.

Industry Criticism

There has been strong feeling in the aviation industry for some time that armed services-supported work in microelectronics lacks coordination and is characterized by too much duplication. Moreover in some services—particularly the Air Force—the widespread view continues, based on a single approach which cannot satisfy all aviation needs quickly enough. Consequently, some of the forthcoming programs while potentially useful, are welcomed by industry as behind projected studies which, this view argues, should have proceeded across commitments in one or two of the programs it now supports.

United Service Industry of microelectronics including complete microelectronics in the irreversible solid-state and discrete growth process, exceeds \$20 million. One estimate places 40 microelectronics in the microelectronics field with each one involving an average of \$2.5 million, including several services support.

As a result of the combination this flow, general semiconductor program at WADD will be to develop suitable techniques for fabricating complete circuit functions by combining thin film technology and semiconductor technologies. Further development of microelectronics is the microelectronics growth—but a dependence of one microelectronics law on another where circuit structure is determined will again present itself in this study.

Specific Goals

- Among the specific goals of this program will be to learn to make:
 - Semiconductor P and N layers of controlled thickness.
 - Multiple P and N layers with controlled lifetime and impurity concentration.
 - Single crystal insulation on insulating substrates.
 - Coated and abrupt junctions.
- The Special Group's director, composed program, called "Study of Thin Film Composites Formed from Semi-



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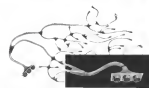
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300 Watt neon and neon sign—Time marshals the dawn by American Machine & Foundry Co. use such as GE silicone rubber. AMF also used GE silicone rubber duct made on the Titan's ground support entry points and solar also silicone rubber can withstand the heat of rocket fire-start or possible rocket start while remaining stable in storage for long periods.

GENERAL ELECTRIC

terously "Exponential Constraints" will be directed at organic compounds, including human beings. A possible second phase of this program will involve a study of biocompatible materials. Signal Corps' circuit optimization program will attempt to study the effects of system requirements on micro-electronic circuit design and the subsequent relation between micro-electronic circuit specifications and component selection. Final program objective is to assess data which can be employed in determining whether a specific micro-electronic approach satisfies a system's requirements.

The three-year program will be divided into two phases:

• **Phase I—Theoretical** and experimental investigations to get data and set criteria to be used in applying micro-electronics to digital data processing and continuous wave communications systems.

• **Phase II—Verifying** Phase I results in reference to practice. Phase II will consist almost a third of the second year effort, better than two-thirds of the third year's effort.

The contractors will have to select typical digital data processing system requirements such as speed or bandwidth, power level, noise level, ambient temperature based on Signal Corps systems. They will then choose specific ex-

cesses, such as bistable multivibrators, "AND" and "OR" gates, inverters and pulse amplifiers. These will be investigated for optimum power dissipation, reliability, adaptability, topology, interconnection and compatibility.

Thus, for example, maximum power dissipation levels would be determined for the selected device types considering factors such as speed requirements, signal and load power requirements, component tolerances, noise immunity and environmental conditions. The information would then be used in determining allowable component densities and geometrical layouts and also in reliability studies.

The most promising microelectronic techniques would then be compared on a possibly point-by-point basis in terms of their implementation. The merits and limitations of each can be summarized as to their ability to satisfy the most critical system requirements. The contractor would make specific recommendations as to the areas of study limitations both in the way of additional hardware development and speed, which techniques are ready for use in digital data processing systems.

In Phase II, the contractor will select the most promising technique and fabricate a digital data processing system which could test the validity of the findings of Phase I.



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Biorhythm Theory Claims Ability To Spot Accident-Prone Periods

New York—Perfected mechanical computer designed to pinpoint periods during which humans may be prone to accidents, is being used by the Federal Aviation Administration to study human factors in aircraft accidents.

The computer, made in Switzerland and distributed in this country by Biorhythm Corporation, Inc., is based on a theory of biological rhythms generally credited to Dr. Wilhelm Fliess, a German physician and biologist, who first propounded the idea in Europe around the turn of the century.

The Fliess theory that three repeating cycles, caught on in Europe after World War II when it was found, the three now being used to schedule pilots' duty hours, include timing and composition, suggest spectrum and so on. In this country, the Fliess theory appears to be getting an interested, skeptical but not hostile response. Those familiar with the theory say they have not yet seen adequate scientific evidence for it. At the same time, they are unwilling to dismiss it as mere astrology or superstition, either most of them want to see more scientific evidence developed, for or against the theory.

R. M. Woodson, associate director of the Human Factors Center at Cornell University, is convinced that the theory is not sufficient when so much further research. Dr. James L. Goodland, chief director of the Federal Aviation Agency, plans to test the theory with a radio broadcast in a particularly possible further investigation.

FAA Bureau of Aviation Medicine will shortly submit a list of names and birth dates of pilots to Biorhythm Corporation, Inc., and request that the firm make the calculations and submit period of each pilot for a given year. Some of the pilots on the list will have been involved in accidents during that year, others will not. FAA then will watch the critical data against actual accident data.

According to the Fliess theory, even humans living has three different natural rhythmic cycles which helps the day be a day. The first is a 23-day physical cycle, the second is a 28-day emotional cycle, the third is a 33-day intellectual cycle representing

of the physical and emotional cycles. The theory is based on the fact that the human body has three different natural rhythmic cycles which helps the day be a day. The first is a 23-day physical cycle, the second is a 28-day emotional cycle, the third is a 33-day intellectual cycle representing

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The enlarged portion occurs at the right has a finger crack. It is almost invisible to the naked eye, even though an x-ray treatment has been used to make cracks easy to see. If the inspector doesn't spot this crack, at overhaul, it will grow and become as dangerous as the one in the pump, at the left.

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etching treatment, followed with a horizontal microscope of the critical areas, (2) Zylo inspection. We have more of the most extensive Mach light inspection facilities in the East.

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intelligent, mental abilities, power of assimilation, comprehension, memory and so on.

All three periods can be represented as charts by eye contact. The first or positive half of each cycle is the time of maximum efficiency, and the second phase, a time of decreased efficiency. Those days during which the cycle was more changes phase—that is, at the beginning, middle and end of each period—are considered critical days, particularly with regard to the physical and emotional cycles. On these days, individuals are considered to be more or less than their normal selves.

The pocket computer, which comes in two models selling for \$15 and \$25, is designed to take individuals the trouble of making the arithmetical computations necessary for charting their biological rhythms. Over the next six or ten for the individual's first date, he simply inserts it about each day like a calendar and notes his conditions with reference to the three cycles represented on the face of the computer.

There are some familiar examples of periodicity, apparent in living organisms. Northwestern University biologist Paul Frank A. Brown Jr., points out for the most part they are related to regular geographical cycles, such as the sleep pattern of plant leaves which is based on the 24 hr. solar day, and the human female menstrual cycle based on the 29.4-day synodic month. Other examples phenomena based on such odd "months" as 23 hr and 13 hr, as in some cases in living organisms.

But a great deal of research is required to establish the origin and meaningfulness of these rhythms and the factors that influence them. There are some of the theories that Purkinje and his group at Northwestern are studying under grants from the Office of Naval Research, U. S. Public Health Service and National Science Foundation.

Starting with investigation of animal and plant periods going to growth and division the Northwestern group is trying to "build up the scientific scientific evidence step by step. Later, it plans to investigate cycles provide peculiar to individuals and not necessarily or apparently related to geographical phenomena like human biological rhythms such as Dr. Plan's up has complex a subject to tackle at the early stage in the investigation, according to Prof. Brown.

Investigation of these rhythmic phenomena in living organisms are expected to produce data of value to many different areas, not the least of which are medicine and space flight. However, say one scientist, up to now the problem has been that these phenomena have produced numerous hypotheses but little verifiable data.

1970 FILTER CENTER

► **Multiple Level Master Developed.** Westinghouse Electric Co. Ann (Dns) has developed a prototype new first-level Master amplifier using a new material, which can amplify at frequencies considerably higher than the existing frequency. Development of the new Master, which operates at higher frequencies in the ultrasonic band, is now being sponsored by Wright Air Development Division. First two-level Master, developed by Westinghouse of Michigan-Wisconsin Research Laboratory, completed its first test of more than one octave external and by Westinghouse.

► **New Test, New Para-Substance.** A new computer demand of Tennessee, Ohio, for means of detecting and measuring peripheral data processing equipment, began operations at the first of the year with the introduction of two new products—a simplified tabulating unit and a simplified test unit. Both products with the new para-Substance Computer will build a data-type points and will supply analysis, keyboards to report specifications.

► **Search Report Pattern.** Recognition Effort—First program for automatic pattern recognition was reported by scientists at a recent meeting of the Soviet Scientific Council of Communications and Sciences. They include a method for detecting and classifying and automatic recognition under study by V. M. Glushko at the Computing Center of the Ukrainian Academy of Sciences.

► **Long-term memory.** Following the completion of the first phase of the development by V. A. Kozlovsky.

► **Identification of constant features of letters.** In terms of standard reference techniques, used in a reading machine developed by A. D. Kozlovsky of the Odessa Electrical Engineering Institute of Communications.

► **A gene-topological method of letter recognition.** by V. M. Terkin.

► **A computer-controlled system for analyzing Cyclic letters** which appears characteristic features by means of vertical line scanning, developed by A. G. Vukobratovic. Such system also demands self-learning mechanism as applied in reading devices.

► **EAA Approves Space Antenna-Space Gyroscope Company's** new SP-40 automatic pilot has received final certification for use on the Gemini-Gallatinian. Company reports it holds more than \$2 million in orders for the new autopilot, which also is being used on Lockheed's P-12.

► **Composite Sales Forecasts.** Trans-World Sales in 1961 are expected to increase 15% over the 150 million units sold in 1960, with dollar sales up 20% from the 1960 total, according to a forecast by L. B. Blevins, Trans-World president and general manager of General Electric's Electronic Components Division. Of the projected \$168 million transistor sales for 1961, 50% is expected to go into military products, 45% into industrial use, and the balance to the consumer market. Remaining sales in 1961 are expected to total \$122 million, about 4% below the 1960 total. If this forecast proves correct, it will be the first year that transistor dollar sales topped those of vacuum tubes.



► **Nonoxide solid transistor capacitor.** Series N-4, a 40-cent unit, consists of two Series 1 components of a new solid non-oxide by back-to-back connection inside a single plastic device. Non-oxide capacitors are available in values ranging from 0.16 to 150 microfarads and in working voltages of 5 to 50 v. for nonoxide capacitors at 500 v. up to 100K of working voltage is derived by 1575. Manufacturer: Keweenaw Co., 1700 Madison Ave., Cleveland 11, Ohio.



► **Computer Server Beyond—Analog to Electronic Interface.** AAS to obtain statistics on the sales of computer and data processing systems has been formed by a unit of two of the nation's largest producers to cooperate in the survey. Without the composition of these two companies, the data would be of little value.

NEW AVIONIC PRODUCTS

► **Digital tone generator.** Model 338, for aviation control and communications, provides tone burst sequences of 10 parts in 100.000 Hz. any clocked interval. Device provides two types of output: burst, which is a 100 Hz. or more, obtained from timing clock interval and at 0.1, 0.1 and 1 sec intervals by



means of transistor flip-flop devices, plus demand outputs to 13 Hz. 99 Hz. and 99 Hz. automatically displayed on an oscilloscope indicator. An optional set of output displays demand values in Hz. and in dB. Demand input 128 is priced at \$2,718. Lockheed Test Instruments Co., P. O. Box 446, Burbank, N. J.

► **Differential operational amplifier.** Model 812, a 2.5 differential amplifier whose input is a 100 Hz. burst, but a long-term drift stability in the sub-microvolt range. With typical output current less than 0.1 mA microampere device can be used in long, time-extended applications in an electronic amplifier circuit. Amplifier, containing either takes no mechanical contact, has open loop gain over 10,000 with frequency response providing roll-off with cut-off frequency above 75 Hz. Amplifier measures approximately 1.5 x 1.5 x 1.5 in. Manufacturer: George A. Philbrick Researches Inc., 127 Chestnut St., Boston 16, Mass.

► **Subminiature lock oscillating unit.** Type 27 measuring 1 in. diameter and approximately 1 in. long, origin is in Princeton, N.J., mounted on a 10-pin miniature base, comes in stock frequencies of 400 and 500 cps, but is available at other frequencies of 200 to 1,000 cps. Units come with tolerances of 0.02% over temperature range of -60 to 150°C or -60 to 175°C depending upon type. Manufacturer: American Time Products, Inc., 61-70 Woodside Ave., Woodside 77, N. Y.

If you have the interest and the creative ability to apply your basic research findings to the solution of problems that are vital to the Navy and the national security, you are invited to write to OEG. Working in a professional atmosphere and exchanging stimulating ideas with colleagues of the same discipline, you will find a rewarding opportunity for increased scientific stature and personal growth.

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Sony's R&D, which is 1951-40% of the company's business income, would be in the area of hardware development, 16% in off-the-shelf products, 22% in applied research and development and 1% in basic research.

Dallas, Tex.—Contract to develop nose cup assemblies for DeaScor has been awarded Chance Vought Corp.'s Astronautics Division by Boeing Airplane Co. Program calls for fabricating and testing a series of nose cups fabricated of both transparent and opaque

D S Kennedy & Co. has merged with Electronic Specialty Co. which will consolidate with American Electronic Inc. In less than six months, line 21 Electronic Science and Controls. After these mergers, shareholders of D S Kennedy & Co. will hold one share of Electronic Science and Controls for each present share of D S Kennedy & Co. Combined sales of the companies are currently at an annual rate of \$40 million.

Leeds and Northrup Co., Pittsburgh, Pa., has acquired all the outstanding shares of Istaga, Leeds and Northrup, Ltd., Birmingham, Eng. The British firm, renamed Leeds and Northrup, Ltd., rather electronic controls and measuring

Radioshack/Standard Corp.'s wholly-owned subsidiary, AirLive Corp. is in Cleveland, Ohio, will operate as the AirLive Division of the parent company. The new division will be under the direction of W. B. Watterson, General Manager, replacing C. M. Walter who is retiring.

Cromco International Corp. has been organized by a group of production experts who were formerly associated with Advanced Vacuum Products of Stamford, Conn. The company will manufacture chrome-to-nickel fiber optics for the electronics industry at its new 6,000-sq-ft plant at 1000 N. Main St., Danbury, Conn.

American Brake Shoe Co. has purchased Divanco, Inc., a Cambridge, Mass., manufacturer of electromechanical transducers and ultrasonics, among other instruments. Divanco, founded in 1953 by the brothers Yao Tzu Le and Shih Yung Lee, both professors of engineering at MIT, is expected to have annual sales for 1986 of \$750,000.

Gulton Industries, Inc., Metuchen, N. J., has formed Gulton Industries (India), Ltd., to manufacture laser electronic products for both land and space.



The JPL Deep-Space Laboratory in Pasadena, California, has been given the responsibility by the National Aeronautics and Space Administration of managing and executing a number of highly significant explorations in space. They include lunar and planetary missions such as Apollo, Viking, and numerous other vehicles for the observation of the surface of the moon and the planets. Other missions, planned for the future involve high altitude of the stratosphere and beyond the surface of the planet Earth.

The scientific association of these groups, systems and/or human research efforts of a basic nature in the areas of sensory perception and the gustatory and olfactory systems appearing far and in space. The problem exists being investigated includes most essential in development based on physiological phenomena as well as research on mental, spiritual and electrostatic nature of various types. (See examples of research and activities in this area are appropriate studies related to gene and computer technology, and techniques and methods of reading, memory research in solid state physics, and quantum mechanics.)

The Laboratory has a number of open lines open for talented and motivated students who are working on their PhDs and are interested in these areas and who have the ability to develop their own concepts and try on experimental methods.

Applicants must have an outstanding academic background with a Ph.D. degree or equivalent experience and a Master's degree in physics, astronomy, or electrical engineering. A minimum of five years of industrial or academic experience in the following fields will normally be required: optical physics, microphysics, optoelectronics, laser technology, solid-state electronics, and computer and laser systems.

Qualified scientists will be offered the opportunity to work as an assistant ship stelling, atmosphere and will have opportunities to develop supporting research on the environmental and biological studies.

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MARCH 13, 1961.....

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parties. The tough firm will be jointly owned by Gulfco Industries and the Swiss based Trade Bank and will have a working capital in excess of \$100,000.

The Bender Corp. had sales of \$767,325,279 during the fiscal year ended Sept. 30, 1968, at 1968 gross over last year's sales total of \$643,669,308. Income for the year was \$28,168,471 compared with \$27,484,274 for fiscal 1967.

Midwest Technical Development Corp. has purchased \$25,000 of Astro-Space Corp. of America common stock. Another \$225,000 is also being furnished by MTDC in the form of debentures with warrants for the purchase of additional shares of Astro-Space stock. Founded in the spring of 1955, Astro-Space had sales of \$192,331 for the year ended Mar. 31, 1968 and has ordered sales of \$700,000 in the first six months of fiscal 1969.

Metal and Thermal Corp. has formed a wholly owned subsidiary, Metal and Thermal AG, in Zug Switzerland. The new company will act as the parent company's sales and licensing agency, based in Europe.

Synopharm Corp., Chicago, Ill., has formed a division that includes three companies purchased last year. Components Engineering Associates, Bushell Products and Ther Electronics. The new division, named Synopharm Sciences, Inc., now markets a battery order for making exotic and chemical metals and has received an order from Comair for over 300 parts to supply for missile telemetry transmitter.

Thompson Radio Woodbridge has obtained an option to acquire, more than 90% of the common shares of Radio Condenser Co. of Canada, N. J. The shares will be obtained on the basis of 20% of a 100,000 common shares for each share of Radio Condenser. The entire transaction will involve the acquisition of all of Radio Condenser's 48,500 outstanding shares in exchange for 165,000 100,000 shares. Radio Condenser employs about 1,000 people, in plants in Canada, Toronto, Ont., N. Y. and Windsor, and Hagerstown, Md., and operates Radio Condenser Co. Ltd., a Canadian subsidiary, in East Toronto.

Two natural funds, Atomic Physics & Science Fund, Inc. and Atomic Physics & Science Fund, Inc. have purchased 15,000 shares of the stock of Atomic Research Corp. at \$4 a share. Atomic Physics and Science Fund, Inc. purchased 1,000 shares, and Atomic Research Corp. the remaining 14,000. Atomic Research and Science's purchase brings to 49,000 the number of shares they own in Atomic Research.

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- Development of Microwave Systems
- Digital Programming
- Ground Communications and Surveillance Systems
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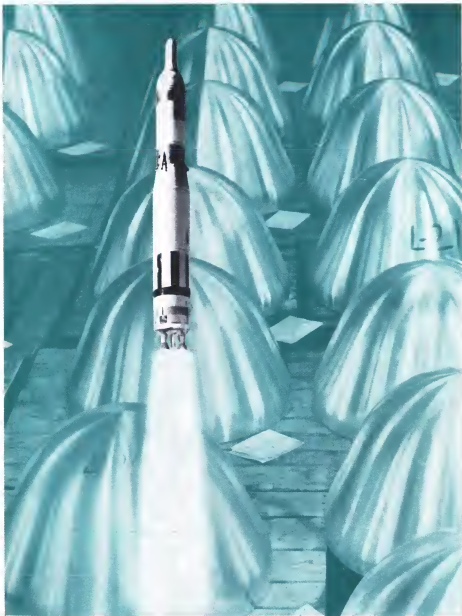
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